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COMMEMORATION OF THE REIGN OF QUEEN ELIZABETH.

The meeting of the Society on March 23 was devoted to the commemoration of the great geographical and exploring enterprises of the reign of Queen Elizabeth, in connection with the tercentenary of her death. Addresses were given by the President, Mr. Edmund Gosse, Mr. Julian Corbett, and Prof. Silvanus Thompson. At the same time there was an exhibition of books, maps, atlases, portraits, instruments, medals, and other objects relating to the great enterprises of this reign, many of them being kindly lent by public institutions and private individuals. The following are the addresses which were given at the meeting:—

I.

Address by the President, Sir CLEMENTS R. MARKHAM, K.C.B.

Let us not forget. On this tercentenary of the death of Queen Elizabeth especially, let us not forget that the beginnings of nearly every department of our science date from the labours of Elizabethan worthies. A geographer should know the history of each branch of his work, tracing its advances from generation to generation, and keeping in memory the beginners and the improvers whose work we inherit. A commemoration such as the one for which we are assembled this evening is intended and, I think, calculated to renew such knowledge, to freshen such memories. An accomplished writer has very truly said that "much interesting and even precious intellectual treasure is continually being lost through forgetfulness, and becomes again new if faithfully set forth once more." Our work to-night is faithfully to set forth the beginnings of our science during the great Queen's reign, that their history may not be forgotten, but become again new.

Queen Elizabeth was the fortunate sovereign of our first great discoverers and explorers, of our first really eminent compiler of voyages of discovery and exploration, of the enlightened and munificent promoters of geographical research, of our first accurate cartographers, of the authors of our first navigation books, of our first instrument-makers, of our first magnetic observers, of all those who laid the foundations of English geography on a scientific basis. There were several causes for this extraordinary activity during the memorable reign we commemorate, but the personality of the Sovereign, and the affectionate devotion she inspired, were, I am certain, not the least among these causes.

THE "ARMADA MEDAL." STRUCK BY QUEEN ELIZABETH TO COMMEMORATE THE DESTRUCTION OF THE SPANISH ARMADA, JULY 29 TO AUGUST 7, 1588.

The names of the great Queen's explorers and discoverers are still household words among us after three centuries—Raleigh and Humphrey Gilbert, Hawkins, Drake, and Cavendish, Burroughs, Frobisher, and Davis, and Lancaster; and among travellers by land, Jenkinson and Fitch. There were many others, but these stand forth pre-eminent. Sir Walter Raleigh's services will be in abler hands than mine. Sir Humphrey Gilbert, the distinguished soldier and advocate of Arctic discovery, was an Eton boy. He founded the first British colony, and his memorable last words were a fitting close to an heroic life. They shed a lustre on the annals of his country, and on the annals of his old school. Another Eton boy, to be mentioned directly, did good work for geography in Queen Elizabeth's time.

To Sir John Hawkins and his son Richard we owe the voyages to the coast of Guinea, to the West Indies and Florida, to Magellan's strait, and the west coast of the Pacific. But we owe much more. Sir John was an honest public servant and a diligent reformer. He put a stop to many abuses as treasurer and comptroller of the navy, and of course made enemies; but he never lost the Queen's confidence. Aided by Drake, he instituted a fund for wounded and worn-out sailors, which was long

SIR JOHN HAWKINS.
(From a wood engraving.)

known as the "Chest at Chatham." Sir John Hawkins was one of the best of Elizabeth's great sea-captains. He was a thorough seaman, and an able and upright administrator. Endowed with great courage and unfailing presence of mind, "he was merciful," says Maynard, "apt to forgive, and faithful to his word." His son Richard was a true chip of the old block. His 'Observations' show that he was something more than an explorer. They are full of shrewd remarks on all that appertains to a ship and its furniture; and, above all, they show the thought he

gave and the care he took for the health and comfort of the sailors. Both father and son were splendid types of English maritime explorers.

The deeds of a still greater seaman, Sir Francis Drake, will be dealt with presently by an abler hand than mine; then we have Thomas Cavendish, the second circumnavigator, and the Arctic voyagers, Frobisher, Burroughs, and Davis, who first introduced their countrymen to floes and icebergs, and described the perils of ice-navigation. Frobisher made three voyages to the land on the west side of Davis strait, which the Queen named "Meta Incognita." Burroughs was not only a polar explorer, but also an excellent hydrographer, and a scientific student of astronomy and magnetism. The discoveries of John Davis are shown on the Stockholm chart more particularly. They led directly to further discoveries. What he called his "Furious Overfall" lighted Hudson into his strait, and his famous cliff known as "Sanderson's Hope" lighted Baffin into his northern bay. Davis also was a scientific seaman and pilot, as well as a discoverer. He wrote the 'Seamen's Secrets,' and invented the back staff, and he piloted the first fleet of the East India Company round the Cape. James Lancaster of Basingstoke was another great sea-captain, the first to round the Cape of Good Hope, and the commander of the first fleet of the East India Company.

Elizabeth's travellers by land exceeded, in the length and importance of their journeys, all Englishmen that had gone before them. Anthony Jenkinson, crossing Russia from the White Sea, reached the Caspian, Persia, and even far away Bokhara. Ralph Fitch was England's pioneer to India. He crossed the peninsula, had an interview with the great Emperor Akbar, to whom Queen Elizabeth had sent a letter, and even visited Burma and Malacca. Nor should his fellow-traveller, John Newbery, be forgotten. He combined energy and courage with prudence, and was a splendid type of an Elizabethan Englishman.

The Queen's adventurous sea-captains and land-travellers form an unrivalled gallery of discoverers and explorers. But not less worthy to be remembered is the indefatigable recorder of their labours, Richard Hakluyt, the personal friend of most of them, the hearty well-wisher of all.

Elizabeth was the re-organizer of Westminster School, and she watched the progress of that "fruitful nursery" of great men with maternal care. Dean Goodman was her special choice. Camden, the most eminent topographer of her reign, was Head Master. When, in 1564, the Queen went to the Dean's house to see the Westminster boys act a Latin play, young Richard Hakluyt was one of those boys. The armour was lent by Secretary Cecil, the dresses came from the Revels; but this was years before there was any theatre or company of grown-up actors. Besides Latin plays performed before the Queen, young Hakluyt's great delight was the study of geography at his cousin's

rooms in the Middle Temple. He learnt things about geography which, he tells us, were of "high and rare delight to his young nature." Geography completely fascinated him while at Oxford, and he clearly saw the two great needs of his country. The first was caused by the ignorance of our seamen as regards the scientific branch of their profession. The second was the absence of records, and the way in which important voyages and travels were allowed to fall into oblivion. For

SIR MARTIN FROBISHER.
(From a wood engraving.)

instance, not a single line of writing by John Cabot had been preserved. Hakluyt set to work, on leaving Oxford, with patriotic zeal to remedy these evils.

He began by delivering lectures on the construction and use of globes, maps, and nautical instruments, "to the singular pleasure and general contentment of his auditory," he tells us. He strove to get a permanent lectureship established "as a means of breeding up skilful seamen and mariners in this realm." His first work, entitled 'Divers Voyages touching the discovery of America,' was published

in 1582. This book was the first impetus to colonization. But the great work of his life, the 'Principal Navigations,' did not appear in its completed form until 1600. It is a monument of useful labour. It not only gave a stimulus to colonial and maritime enterprise; it inspired our literature. Both Shakespeare and Milton owed much to Hakluyt's 'Principal Navigations.' Our Westminster boy, as the years rolled on, continued "to wade further and further in the sweet studie of geography" until he achieved his great work, which was, in his own words, "to incorporate into one body the torn and scattered limbs of our ancient and late navigations by sea." Hakluyt has ever since been a rich mine of information for all inquirers; and in a few years I hope that we shall have our old friend reprinted in a series of handy and portable octavo volumes, for everybody to read and enjoy.

Hakluyt and Sir Walter Raleigh were the two principal promoters of the colonization of Virginia, therefore of the foundation of those colonies which eventually formed the United States of North America. For Virginia was then the whole of North America, except Florida and Norumbega; and Elizabeth, as we know from the title-page of Spenser's 'Faerie Queene,' included among her titles that of Queen of Virginia. Hakluyt, among his many and great services, led the merchant princes of that memorable reign to become the munificent patrons of maritime enterprise and of geographical research. Their names should ever be had in honour, and the chief among them should have a place in any commemoration of Elizabethan geography.

These Elizabethan merchants felt that they could not better serve their country than by despatching exploring expeditions and advancing geographical science. Sir Thomas Smith was one of the most eminent. He was an active member of the Muscovy Company, and was an adventurer for the first voyages to Spitsbergen. He took a leading part in the foundation of the East India Company, and was its first governor. He was ever mindful of Arctic discovery, and was the first governor of the North-West Company, gathering round him several other generous patrons of geography. His name was given by Baffin to Smith Sound, one portal to the polar ocean. But Sir Thomas Smith was not only an encourager of exploration; he also promoted the interests of the scientific branches of a seaman's profession, yielding to the persuasions of Hakluyt. Lectures on navigation were delivered at his house in Philpot Lane by Dr. Hood and by Edward Wright.

Other great patrons of geography were Sir George Barne, an adventurer of the Muscovy Company, who was at a meeting in Dr. Dee's house at Mortlake when John Davis's Arctic voyage was discussed, and whose descendant, Michael Barne, is now serving in the Antarctic Regions; and Sir Edward Osborne, the founder of the Levant Company and patron of the journeys to India, whose romantic story is so well known to us all. But there were many more, and the patriotic munifi-

cence of her merchant princes, in fitting out voyages of discovery, is one of the glories of Elizabeth's reign.

We must remember one other geographically minded merchant, Mr. William Sanderson of the Fishmongers' Company. He was the munificent patron of the Arctic voyages of John Davis, and all northern explorers who are fond of guillemot soup will remember him in connection with the great loomery on the perpendicular cliff which was

SIR RICHARD GRENVILE.
(*From a wood engraving by E. Harding.*)

quaintly named by Davis, "Sanderson his hope of a North-West Passage."

Sanderson also paid for the construction of the famous Molyneux globes, one celestial, the other terrestrial, which are embellished with his coat-of-arms, and dedicated to the Queen. This is what he wrote upon them—

"Lo, at my charge thou seest the ever-whirling sphere,
The endless reaches of the land and sea in sight appeare,

> For countries good, for worlde's behoof, for learnings furtherance,
> Whereby our virtuous Englishmen their actions may advance,
> To visit forraine lands where farthest coasts do lye,
> I have these worldes thus formed, and to worldes good apply."

"And to worldes good apply." This is, I believe, the secret of England's greatness. Other peoples work for their own "countries' good." England alone has ever worked for "countries good" *and* for "worlde's behoof." The globes, which you will see in the next room, were finished in 1592. They created a great sensation among scientific men. Manuals for their use were published by Dr. Hood, and by Robert Hues in his 'Tractatus de Globis et eorum usu,' as well as by Blundeville in his Exercises. For it must be remembered that, before the use of logarithms, seamen were accustomed to work out their astronomical problems on globes—a most excellent method, in use, I believe, for instruction even now by our map curator, Mr. Reeves. It enables the mind of the student to conceive the great triangles in the celestial concave by which the problems of nautical astronomy are solved. John Davis said that "the use of the globe is of great ease, certainty, and pleasure—of all instruments it is the most rare and excellent."

This brings us to the Elizabethan maps, and first to that famous map of the world, which, in *Twelfth Night*, Shakespeare called—

> "The new map with the augmentation of the Indies."

It is the first English map on the so-called Mercator's projection. But it is really Edward Wright's projection. The Cambridge student made a voyage with the Earl of Cumberland, and thus applied the test of practice to his theories. This led him to turn his attention to the improvement of charts then in use; and the map of Mercator first suggested to him the correction of the many and grave errors in charts by increasing the distance of parallels from the equator to the pole. "But," says Wright, "the way how it should be done I learnt neither of Mercator nor of any one else." In 1594 he discovered the true method of dividing the meridian, and his table of meridional parts was published by his friend Blundeville in the same year. His own work, entitled 'The Correction of certain errors in Navigation,' explained the principle of the division of meridians, the manner of constructing tables of meridional parts, and their use in navigation. Before Wright's calculation of the tables, Mercator's projection was practically useless. Afterwards it became most valuable, and was soon in general use. The first map on Wright's principle, like the Molyneux globes, attracted much attention. It was well covered with rhumb lines, and not very well engraved, for engraving was still in its infancy in this country. In Shakespeare's play of *Twelfth Night*, Maria says of Malvolio—

> "He does smile his face into more lines than are in the new map with the augmentation of the Indies. You have not seen such a thing as 'tis."

There is also an allusion to the Dutch discoveries under Barents on the coast of Novaya Zemlya, which first appeared on Wright's map. Fabian says—

> "You are now sailed into the north of my Lady's opinion; where you will hang like an icicle on a Dutchman's beard, unless you do redeem it by some laudable attempt, either of valour or policy."

And this allusion to Barents is an occasion for recording the great interest taken by Queen Elizabeth in the progress of Arctic discovery.

SIR WILLIAM SANDERSON.

(*From a wood engraving.*)

She ordered Sir Francis Vere, her general in the Low Countries, to keep her informed on the subject as regards Dutch enterprises; and the result of this order was a very fair account of the discoveries made by William Barents, from Sir Francis, in a letter to the Queen.

The Molyneux globes and the first chart on Mercator's projection were landmarks in the cartographic history of the Queen's reign, but they by no means stand alone. Very memorable is the survey

undertaken by Saxton, of England and Wales, under the auspices and protection of the Queen. It was the first field survey, the forerunner of the Ordnance Survey. The final result was the atlas, with a fine portrait of Queen Elizabeth on the frontispiece, beautiful copies of which will be seen in our collection. Saxton was followed by Speed the historian, whose atlas was based more or less on Saxton. The survey of Saxton is also the basis of Edward Sheldon's curious tapestry large-scale maps of the midland counties, woven by Flemish workmen brought over by Sheldon, and established at Barcheston. Two of these maps are at York, and two in the Bodleian. Their date is about 1588. It will be remembered that Mr. Bedford exhibited the York maps at one of our afternoon meetings in 1896.

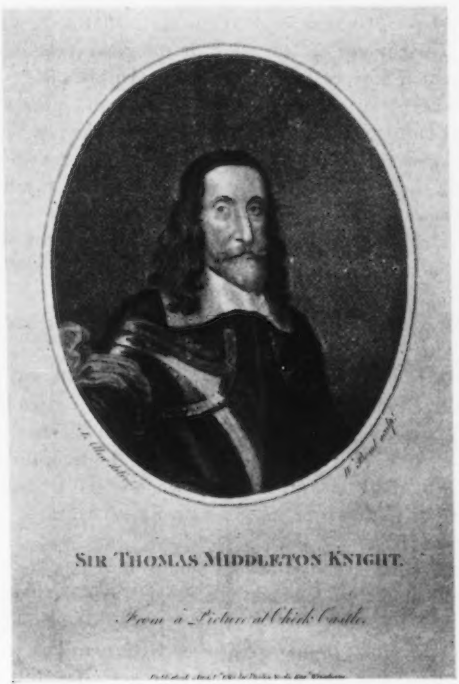
Charts for use on board ship, and particularly for expeditions of discovery, were specially drawn by hand by experts, and were on a large scale. Their provision depended on a knowledge of former work, and their construction required a good acquaintance with the principles of nautical astronomy, as then understood, and with the use of instruments.

The need had arisen for the best navigation books and improved instruments, both for the map-maker and the explorer. At first there were translations only. Ashley translated the 'Mariner's Mirror' from the Spieghel of Wagenaar; and the Spanish navigation books of Medina and Cortes were translated into English by Frampton and Eden. But soon our English scientific geographers began to produce original works. Cunningham's 'Cosmographical Glasse' appeared as early as 1559.

The value of the contents of English navigation books kept pace with the inventions connected with instruments for observing the heavenly bodies at sea. William Bourne, of Gravesend, in his 'Regiment of the Sea,' insists upon the duty of a captain of a ship to have knowledge, not only of charts, but also of instruments to take the height of the sun or stars. Nor were our Elizabethan sailors slow to seek instruction in the scientific branches of their profession. Bourne describes the use of the astrolabe and cross-staff; but his book, published in 1577, is chiefly interesting because it is the first in which the method of ascertaining the rate of a ship by means of the log and line is described. Humphrey Cole, the engraver and instrument maker, had, even at an earlier date, invented some plan for measuring the rate, analogous to Massey's self-registering log.

But the leading lights in Elizabethan nautical astronomy were Hues and Hariot, and somewhat later Briggs and Gunter; and it is worthy of note that most of them had their wits sharpened by long sea-voyages before they buckled down to their studies. Robert Hues had made a voyage to Virginia, and had knocked about with Cavendish in the Straits of Magellan, before he sat down to explain all the problems that

can be solved by the use of a globe. Thomas Hariot had made two voyages across the Atlantic to Virginia before he wrote his great work on algebra, and applied the telescope to observations of Jupiter's satellites, simultaneously with Galileo. Hariot, says Dr. Wallis, laid the foundation without which the whole superstructure of Descartes had never been. Edward Wright made a voyage against the Spaniards with the Earl of Cumberland before he calculated his table of meridional parts and constructed his famous map of the world.



SIR THOMAS MIDDLETON.

(From a steel engraving by W. Bond of a painting by J. Allen, at Chirk Castle.)

But perhaps Briggs and Gunter were the greatest of the Elizabethan scientific geographers. For the discovery of logarithms by Napier made a complete revolution in the science of navigation, and Briggs and Gunter brought the discovery into practical use. Briggs went through the gigantic labour of calculating his tables of logarithms of natural numbers. No greater service has ever been done by one man for navigation, and Luke Fox did well to immortalize it by naming an island in Hudson's Bay "Mr. Briggs his Mathematics."

Edward Gunter was a Westminster boy, like Richard Hakluyt, and was elected to Christ Church. He worked with Briggs at Gresham College, and while the former devoted his time to natural numbers, Gunter completed the tables of artificial sines and tangents. He invented and first used the terms cosine and cotangent. Gunter was also the inventor of the Gunter's scale, which we all know well, of the Gunter's chain, of a new quadrant, and of an improved cross-staff.

I have mentioned two Westminster boys, Hakluyt and Gunter. I must not forget Eton. Besides Sir Humphrey Gilbert, William Oughtred was an Eton boy. He was an eminent mathematician, and invented a very useful instrument called the "horological ring," two or three examples of which may be inspected in our exhibition.

It will thus be seen with what diligence and perseverance, with what zeal and enthusiasm, the men of science worked at the preparation of manuals, the construction of maps, and the improvement of instruments in order that the labours of their brethren in the field might be more useful, more accurate, and less perilous. Magnetic observations were also commenced in this reign; but there is a master of that subject present with us, who will presently contribute a short address to our commemoration.

At last, after near upon half a century, the memorable reign drew to a close. This evening, three centuries ago, the great Queen was speechless. Most of her early contemporaries had already passed away. Yet she was still surrounded by relations and affectionate friends. Her most trusted cousin, the great Admiral, was with her to the last. Beautiful Margaret Willoughby was one of the maids of honour to the Princess Elizabeth at Hatfield. Often she might have been seen in those days, in gay attire, in the balcony at Hatfield, talking and laughing with divers in the courtyard. Years rolled on, but her devotion to her beloved mistress did not diminish. As the widowed Lady Arundell, she attended her Queen and life-long friend on her death-bed.

And so, in the midst of her greatness, with many of those who had grown up during her reign still in full activity, full of patriotic schemes and scientific inventions, the great Queen passed away. But the work of her reign lived. The science of geography in England was planted on a firm basis, to grow and thrive. The impulse survived too, and the Elizabethans—the men born and bred in her reign—continued to produce valuable work, to perform great deeds, for twenty and more years at least after her death.

The roll of Elizabethan work, to quote myself in another place, "is indeed a roll of surpassing splendour. In the far north, the 'Meta Incognita' and Davis Strait discovered, and the intercourse with Russia by the White sea strengthened and organized. The Caspian Sea navigated and Bokhara visited. India and Burma made known. A great

fishing-trade established on the Newfoundland banks. Virginia discovered, and a sure foundation laid for the future colonies which were to form the United States. The charter granted to the Turkey Company, and British trade placed on a sure footing in the Levant. Lucrative trade on the coast of Guinea, in the West Indies, and on the Spanish main kept alive by English cruisers. The Orinoco explored as far as the mouth of the Karoni. The world twice circumnavigated. Cape Horn and 480 miles of the west coast of North America discovered.

SIR DUDLEY DIGGES.
(*From a steel engraving by C. Turner.*)

The Cape of Good Hope first rounded by English ships: and a charter of incorporation was granted to the East India Company, which opened the first chapter of the British Empire in India.

"One of the results of Elizabethan exploration and discovery was the extension of British commerce in all directions to the remotest corners of the Earth. Another result was to stimulate, in the highest degree, an enthusiastic feeling of patriotism which no difficulties or hardships could daunt, and no disaster could quench." But for us

this memorable reign should ever be remembered as the time when geography, in all its branches, was fostered and advanced, and when our science had a commencement whence it has continued to grow and increase to the prosperous condition in which it came into our hands. But we must remember that much remains to be done. We can learn much—very much—from our Elizabethan predecessors; from those who penetrated into distant regions, as well as from those who devoted their talents at home to geographical research and to the improvement of geographical methods and appliances. From that point of view, it is well that we should, on such an occasion as the present, pass in review the geographical achievements of the subjects of the great Queen.

II. SIR WALTER RALEIGH.

By EDMUND GOSSE.

In the England which was controlled by that Virgin Queen whom we have met here to commemorate, there were two diametrically contrasted intellectual currents in active force. We are apt to forget the one, the prosaic and realistic tendency, which was represented in literature by domestic plays like those of Dekker, and by sober poetry like that of Daniel. It expressed itself in many practical forms of usefulness. It was so opposed to the picturesque that it averred there was nothing in the world more worth seeing than could be met with between Westminster and Staines. In public life this spirit found its perfect representative in Robert Cecil, that cold and crafty statesman who scorned and distrusted the exercise of the imagination wherever it confronted him. But at the side of this excess of common sense, and incessantly excited, and, as it were, burnished by resistance to it, there moved a class of mind which clothed the unknown in a robe of purple vapour, exalting, transfiguring, exaggerating all remote and unexperienced facts in a magnificent sunset light of glory. And the very prototype of this class of Elizabethan temperament was that paladin of geographical romance, Sir Walter Raleigh.

It is a remarkable tribute to the force and genius of Raleigh that he was recognized in his own age, and has been vaunted ever since as the patron as well as the prototype of geography as a form of imaginative literature. In the popular mind, to this day, he gets credit for what he planned and for what he wished to do, as well as for what he did. So pertinacious is the legend which connects him with Virginia, that I doubt if every one, even in this learned assembly, recollects that Raleigh never set foot in what we call North America. But in the events of 1583, in the epoch-making charter of 1584, in all that excited English sentiment in the settlement of those colonies from Martha's Vineyard to Florida, the moral influence of Raleigh was paramount. His nostrils

never snuffed the fragrant air which blew out into the Atlantic from North Carolina to meet the colonists; in his bodily presence he never touched those aromatic cedars of Wokoken, never tasted the wild grapes of Roanoke. But in spirit he was there through good and evil estate. His was the brain that planned, the persistence that carried out, the courage that would never relinquish the design. And the promised land of Virginia is his in history, although he only gazed at it from the fringes of the cloud.

SIR WALTER RALEIGH.
(From a steel engraving by J. Houbraken.)

Contempt of the cruel and ignorant Spaniard was always burning in Raleigh's bosom. He tells us that Berreo, though a finished hidalgo, and an experienced adventurer in Indian waters, could not distinguish between east and west. Raleigh had no such difficulty in finding his way across the seas. Vice-Admiral of the South-West, he was; and we seem to see him, in our mind's eye, sitting for hours on some promontory of Cornwall, and gazing, gazing across the shrouded ocean. There is a pathetic and penetrating phrase in a letter Lady

Raleigh wrote to Cecil in February, 1594: "I hope, for my sake," she says, "you will rather draw Sir Walter east, than help him forward toward the sunset." That was all his dream; it was for that that he fretted against the coldness and the jealousy and near-sightedness of English statesmen. He longed for this one thing, and with such vehemence that thus and not otherwise posterity sees him, with straining eyes and beating heart, leaning forward towards the sunset.

At last he found his opportunity. In 1595, the man who had always been forbidden to go over to Virginia broke away to a still more romantic region—to the dim and magnetic wilderness of Guiana. He was stayed for a while at the last. "This wind breaks my heart," he wrote. I do not know in the history of the human mind anything more poignant than this fret and agony of delay, which was to be so constantly Raleigh's punishment. The hunting-dog sees and scents the quarry; it is within his reach in a couple of bounds; and always there is this galling and intolerable chain that cannot be slipped. But he slipped it at last in 1595, and he wrote that magnificent and romantic book, the very name of which is like the blast of a trumpet. Let me remind you of the spacious title-page of 1596: 'The Discovery of the large, rich and beautiful Empire of Guiana, with a relation of the Great and Golden City of Manoa, which the Spaniards call El Dorado, and the Provinces of Emeria, Arromaia, Amapaia, and other Countries with their Rivers adjoining.'

It is not needful that I should detail to you the contents of this wonderful volume, for it is your accepted classic in Elizabethan geography. But it is amusing to remember that a hundred and fifty years later all that Hume had to say about it was, "that it was full of the grossest and most palpable lies." Robert Cecil could not have said more when the book was written, nor the man in the street to-day. There is inexactitude in all historic records, and Hume himself is no longer cited for his accuracy. It is hard, it is perhaps impossible, to describe a cab-accident in which you have yourself taken part, without some deviations from the truth. Raleigh was told wonderful things of a tribe of Indians whose eyes were in their shoulders and their mouths in the middle of their breasts, and of another "who have eminent heads like dogs, and live all the daytime in the sea." In such cases as these, we know that he was himself deceived; he did not understand what it was that his interpreters were endeavouring to impress upon him. But we no longer commit the vulgarity of supposing that he set himself to fill out his narrative with "the grossest and most palpable lies." He was ignorant of many things that a child knows now, and his ardent curiosity made him credulous. But in all which he reports from personal experience, the wonder is that in that tropic air his intellect could hold its own as soberly and coolly as it did.

He represents to us, he will always represent to successive generations,

the man who travels, not to lay the foundations of experience, but to set a pinnacle on the finished edifice of his culture. Into the sunset Raleigh took an intellect which was one of the most powerful and most highly trained of the rich Elizabethan age. He was poet, historian, chemist, soldier, philosopher, courtier; he carried with him on his geographical expeditions the prestige, the skill, the basis of ripe thought which all this commerce with the world of men and books had given him. His aim was not merely adventure; it was not merely the picturesque enjoyment of a queer land full of pineapples and parakeets and armadillos. It was not even the desire to find gold for himself and an empire for his Queen, that inspired him. "He shot at another mark than present profit," and he stands for all time as the most splendid example of the geographer and patron of geographical literature who approaches his science in the pure light of imagination.

III. FRANCIS DRAKE.

By JULIAN CORBETT.

In speaking of the glories which Sir Francis Drake added to the reign of Elizabeth, one is confronted with a serious difficulty. They were so many and so great, and for that reason I think I can do no better to-night than confine myself to the greatest of them all. For Drake enhanced the splendour of Elizabeth's reign with one of the four great discoveries of the world. Those four, I think I may say, were the discovery of the Cape of Good Hope, the discovery of America, the measuring of the Pacific by Magellan, and, fourthly, the discovery of Cape Horn, or, in other words, that the Pacific and the Atlantic were undivided. Let us consider for a moment what that meant. The age of enterprise had begun; the desire to find out the ends of the Earth was on fire; Europe was reaching to the west, and across her path from pole to pole was supposed to stretch a mighty continent in the hands of Spain. At no point could it be passed except by the strait which Magellan had discovered lying between the two halves of that great continent, between Peru on the north, and on the south what was then called the Terra Incognita, or Tierra del Fuego. It was felt by every one that so long as Spain was in that position, closing the Pacific against the world, little advance could be made. Drake sailed with the intention of forcing the barrier, but not with any idea or hope of breaking it down. He sailed with the idea of passing the straits as Magellan had passed them. It was an accident of his voyage, partly due to the act of God, partly to his own consummate seamanship, that he did break the barrier down, that he removed the Terra Incognita from the map, and threw wide the gates of the Pacific to the world.

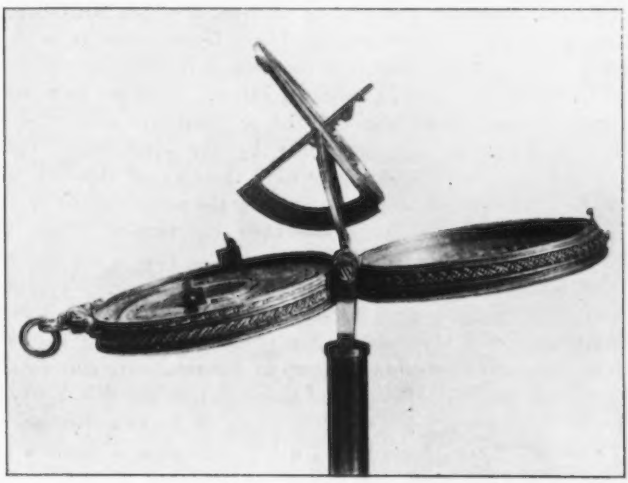
Another reason for dwelling on this exploit to-night is that the breaking of that barrier is generally attributed to some one else. It is attributed to the Dutch sea-captain Schooten and the geographer Lemaire. Now, the first thing that strikes one in reading the account of their discovery is that they refer to a previous discovery, which prompted them to undertake the venture, and it is impossible, as I hope to show you, that that reference relates to anything else but

SIR FRANCIS DRAKE.

(*From a steel engraving of a painting by J. Houbraken.*)

what Drake discovered. But that is not all. For even with the help of Drake's information, Lemaire did not come so near the truth as did Drake. Lemaire came home believing that he discovered, not the open sea which Drake had charted to the south of America, but another strait like that which Magellan had discovered, a strait that lay between Tierra del Fuego and a land he called Staaten Land. He still believed his Staaten Land was part of a great continent that stretched away to the south pole, and that the only two known ways of passing into the Pacific were through Magellan's strait and the one he himself had found.

Now, I know it must strike every one as almost incredible that a discovery so great as the open sea south of America should not have been at once known to all the world, and at once credited to its author; so strange is this that it came to be doubted whether Drake had made the discovery at all. It is doubted sometimes even in our own day; at least, it is not recognized as one of the great, perhaps the greatest, achievements of an English navigator. The reason why it was not at once recognized has recently been revealed to us, but before dealing with this I should like to say a word on the evidence, which makes it perfectly clear that the discovery was a real one. We have first the minute account written by Drake's chaplain, who accompanied him on



ASTROLABE. CONSTRUCTED FOR SIR FRANCIS DRAKE PRIOR TO HIS FIRST EXPEDITION TO THE WEST INDIES, 1570, AND SAID TO HAVE BEEN PRESENTED TO HIM BY QUEEN ELIZABETH.

the voyage—Fletcher. He describes very clearly how, in the great storm which Drake encountered after he passed the straits, he was driven far to the south, how he was driven back to the straits, how he was driven to the south again, and then, being driven northward for the second time, found himself, not to the west of Tierra del Fuego, but to the east. Then, coasting along the islands in fair weather till he came to the most southerly of all, he landed. Fletcher describes how he too went ashore, taking with him his bag of instruments, and how he took the latitude, which he gives quite correctly. Fully alive to the gravity of the event, he further tells us that he set up a stone, engraved with the name of Elizabeth, and the year and the reign, to commemorate the discovery in her honour. That stone we cannot

hope to find, but there still exists in the British Museum the chart he made of the immortalized island. Drake also afterwards told Sir Richard Hawkins what he was doing while Fletcher was taking his observations. Drake sought out the most southerly point he could find, lay down, and grovelled out to the end of the rock, as Hawkins says, till his head hung well over, and then he came back laughing to his ship's company, and bragging that he had been farther south on land then known to the world than any man among them, or than any man who ever lived.

Well, in the face of that very detailed account we ought to be careful how we reject it. But this is by no means all the evidence. On no less than four maps before the end of the century that discovery was charted. We have first a silver placque, on which Mr. Christy has written an admirable monograph. There Drake's voyage is plotted, showing the islands at the south of America, with which he replaced the Terra Incognita, and a fairly open sea below. Then we have another well-known map, which was prefixed to Hakluyt's edition of Peter Martyr in 1587. It was apparently by the same hand; the two almost exactly agree. Thirdly, we have the map of Hondius, which, about the year 1595, he drew to celebrate the achievements of Drake and of Cavendish; and, lastly, we have the famous "New Map" which you have seen on the screen to-night. This is the map which Hakluyt finally adopted for the second edition of his voyages instead of the one by Molyneux, which he had intended to use; and it is very noteworthy that this rejected globe of Molyneux's still shows the antarctic continent stretching right up to America. We may conclude, therefore, that Hakluyt, after mature consideration, was thoroughly convinced of Drake's discovery, and the whole of Drake's discovery; for the "New Map" goes further than all the others, and shows a great open sea at the south of America, or, as Fletcher said, "the South Sea and the Atlantic rolling together in one great flood."

Those bases of evidence are probably fairly well known to most of the members of this Society; but I would venture to say there is another remarkable one which is not so well known, and which shows us clearly how it was that the discovery was not at once trumpeted to the world. It is a letter which the Spanish ambassador wrote in great alarm to Philip II. when he found out what Drake had done. You will remember that a year or two after the *Golden Hind's* return an expedition was set on foot under Fenton to take advantage of the treaties which Drake had made in the Moluccas to the advantage of the English against the Portuguese. There arose a discussion as to which way he was to go. There had been an effort to amalgamate the two schools of navigators, which we may call the Drake school, and the rest. There was a good deal of friction. Drake's men, with the pleasantest memories of what had happened to them before in the South

sea, were anxious to go west-about; the others, more peacefully inclined, wished to avoid a conflict with the Spaniards and go east-about. Drake was asked his opinion. There is no English record of what it was; and we have to go to the Spanish ambassador, who was watching the preparations of this expedition and trying to find out what it meant. The day Fenton's instructions were signed he did find out, and he wrote off at once both by land and by sea to Madrid, and I would venture to read one or two extracts from that long and detailed letter.

After giving particulars of Fenton's fleet, the ambassador says, "They are not going to the Moluccas by the Cape of Good Hope; they mean to make the port of St. Julian and go to the strait of Magellan, which Drake discovered to be no strait at all, and that there was no such continent as depicted in the maps and called Tierra del Fuego, as distinguished from Peru, but only very great islands and channels between them, the inlets being large, as the story goes." He then goes on to relate fairly accurately how Drake —partly by accident and partly by good judgment—was driven round the Horn and discovered the open sea. He then proceeds, "From this situation he judged that he might take what Magellan asserted was a strait to be islands, and that there was no continent, since he had beaten about it in a storm for fifty-four days without finding port. Wherefore, getting a good and fair wind, Drake returned to explore it outside the islands which appear to be a strait, and so came into the South Sea." Then he relates how, when Winter deserted and came home, he brought with him a similar story; but although, he said, "Winter asserted there was no strait, but only islands, he could not be believed till Drake returned."

DRAKE'S ASTROLABE SEEN FROM ABOVE.

He then gives us the solution of the mystery that overhangs the discovery. For he goes on to explain to Philip that for political reasons, only too obvious to the King of Spain, it was being deliberately suppressed. "Drake has not revealed the secret to any one," he writes, "but only to some of the council and some of the promoters of this

company"—that is, Fenton's company. "These men pointed out to him the danger of sending the ships when your Majesty had so large a fleet at the Straits of Magellan." (For Philip was then on the point of sending out a powerful expedition.) Drake replied, "So much the better, because your Majesty's ships, by keeping that station, will feel sure that nothing can pass into the South Sea, and in the end they will find themselves well tricked, because there is nothing but big islands and open sea in the direction of Tierra del Fuego." That was Drake's announcement of his discovery to the council. The ambassador goes on to say, "The person who gave me this information has seen the *carta* and the *platicallo*" (by which he probably meant what was always called the card and the plot by English navigators). Yet, from not being skilled in cosmography, he had not been able to report accurately the degrees. Nevertheless, he has no doubt, and he concludes by alluding to the boast of the English that they will go to the Moluccas and make annexations, as they please. "I send this information to you," he adds, "that you may understand the truth of this, which is considered as a certainty. Drake asserted it as such to these councillors, and it will be to your Majesty's service to instruct the Armada, which is going to the Straits of Magellan, to examine the whole situation thoroughly." From the Venetian ambassador at Madrid, who at once got hold of the information, and sent it on to Venice as a matter of grave importance, we know that this advice was acted on.

Thus we get the whole story and the explanation of the mystery that shrouded the English discovery of the Horn. For purposes of state, too complex to consider to-night, it was for some years kept a profound secret, and although in 1582 the secret was known both in Spain and Venice, it was not divulged to the world till the publication of the first two of those maps to which I have alluded, and which are believed to have been published in the year 1587 or 1586. That is to say, it was kept a state secret until Drake's expedition to the West Indies made war with Spain inevitable. This is the simple explanation. That it should have been divulged at such a moment was in itself suspicious, and the doubt was confirmed by the report which Cavendish brought home. He allowed himself to be misled by the remnants of the Spanish garrison which had been sent to occupy the straits. He made no attempt to ascertain for himself the truth or otherwise of Drake's discovery, but merely came back and said it was not to be believed. After Elizabeth's death, James's subserviency to Spain fully explains why the quest was not carried forward in his reign, but was left to Schooten and Lemaire to verify.

Now, I would venture to say that in the face of the evidence I have hastily outlined it is absolutely impossible to doubt the truth, and not only the truth, but the tremendous political importance of that discovery, an importance which was thoroughly recognized at the time.

The unity of the Atlantic and the Pacific is England's discovery, and England should claim it; she should claim it for Drake and his mistress, whose tercentenary we are celebrating to-night. It would be a bare act of justice—I fear it is quite impossible—but I say it would be a bare act of justice to those two great memories if henceforth we could call that cape, not "Cape Horn," but what Drake called it after his immortal and beloved mistress, "Cape Elizabeth."

NOTE.—The Spanish ambassador's letter is printed in the *Documentos Ineditos*, vol. 91. *Cartas de Don Bernardino de Mendoza*, April 20, 1582.

IV. WILLIAM GILBERT AND TERRESTRIAL MAGNETISM.

By Prof. SILVANUS P. THOMPSON, F.R.S.

William Gilbert, the father of electrical science, was born in Colchester in 1540. Educated at St. John's College, Cambridge, where he took his degree as Doctor of Medicine in 1569, he settled, after four years of foreign travel, in London in 1573, and was admitted to the Royal College of Physicians, of which he became Censor, Treasurer, and, in 1599, President. He was in February, 1601, appointed personal physician to the Queen, whom he attended in her last illness. He came of a well-known East Anglian family, and held extensive landed estates in Essex and Suffolk. He survived the Queen only eight months, dying November 30, 1603.

Gilbert's monumental work, the 'De Magnete,' published in 1600, marks an era in magnetic science. For some four hundred years the employment of the magnetic needle in navigation had been known both in Northern and Southern Europe. While it is possible that the primitive use of the loadstone may be ascribed to the Baltic, it is certain that the employment of a pivoted needle, and the addition of a rose of the winds as a compass-card, both originated in the Mediterranean. The pivoted needle is described in the Epistle of Peter Peregrinus, written in 1269; while the earliest known compass-card marked with the initials of the names of the winds is that ascribed to Andrea Bianco, of 1426, in the Biblioteca Marciana in Venice. The manner of use in Elizabethan times of the loadstone and of the compass may be gathered from Olaus Magnus ('Historia de Gentibus Septentrionalibus,' 1555), from Pedro de Medina ('Arte de Nauegar,' 1545), Martinus Cortes ('Breve Compendio de la Sphera,' 1556), Blundevile ('Exercises,' 1594), Norman ('Newe Attractive,' 1581), Borough ('A Discours of the Variation of the Cumpas,' 1581), Pedro Nuñez ('Instrumenta Artis Navigandi,' 1592), Barlow ('The Navigator's Supply,' 1597), Nautonier ('Mécometrie de l'Eyman,' 1602), and Stevin ('Die Havenvinding,' 1599).

At the time when steering by the compass was introduced into navigation, the compass pointed in Middle Europe so nearly truly to

the north that with the rough instrumental appliances at hand its deviation from the true north was seldom noticed, or, if noticed, ascribed to some error in the setting of the needle. Nevertheless, observations of the deviation were noted, and described as a "variation" or "declination," or a "coasting," or a "north-easting" of the needle. Later the compass-makers began to set their needles slightly askew beneath the card, according to the variation in the place of origin. Norman (1581) states that those used in the Levant, made in Sicily, Genoa, or Venice, had the needles straight, while those used in Denmark and Flanders had them set at three-quarters of a point, or a whole point, to the eastward; while those made in Spain, Portugal, France, and England, had the needles set half a point to the east. Those for Russia were set at "three seconds of a point." Gilbert denounced these devices as tending to obscure the true facts. Gradually it became recognized, probably after the voyage of Columbus, when the manifest change in the declination of the needle nearly caused mutiny of the sailors, that the direction of the needle really differs at different places; and accordingly navigators began to collect data. The record of the voyage of Columbus states that during his second voyage in 1496 he used for steering the observations made on the declination during his first voyage. The "secret" of Sebastian Cabot, which he declared when dying to be a divine revelation to him, can have been little else than the idea of using in navigation the local declinations of the compass. On the other hand, Pedro de Medina flatly denied the existence of the declination, adding that if the compass did not show the pole, the fault lay in the defective construction of the compass itself. Columbus had found a point $2\frac{1}{2}^\circ$ east of Corvo, in the Azores, where there was "no variation," and other navigators explored the "agonic" lines which crossed the Atlantic and the Indian ocean. According to Humboldt, Alonzo de Santa Cruz in 1530 constructed the first general variation chart. But along with this development of practical interest in the subject there grew up a crop of wild legends to account for the irregularities observed. The reason why the compass needle pointed north, and the reason why it did not point truly north, were alike proclaimed to be due to the stars, to the influence of spirits, or to the existence of loadstone mountains of uncertain locality and of fabulous power. The old traditions of the Arabian Nights, dressed in a newer setting, found themselves justified by the insertion in maps of loadstone rocks, the position of which changed at the fancy of the chartographer. Ptolemy had located them in the Manioles; Olaus Magnus declared them to be under the pole; Garzias ab Horto situated them in the region of Calcutta. The map of Johann Ruysch, which adorned the edition of Ptolemy, published at Rome in 1508, showed four magnetic islands in the Arctic circle. Martinus Cortes placed the loadstone mountains in Sarmatia. Mercator in his great chart depicted

two great rocks rising from the sea to the north of Eastern Siberia, one being drawn on the supposition that at St. Michael the compass points due north, while the other is further north on the supposition that the compass points due north at Corvo. The map of Cornelius Wytfliet, 1597, shows the same phantom islands. Blundevile, writing in 1594 of the now lost map of Peter Plancius, mentions that he sets down the pole of the loadstone somewhat to southward of the islands that lie east of Groynelande.

Meantime another significant fact had been discovered* in 1576 by Robert Norman, of Limehouse, compass-maker, namely, the tendency

DR. WILLIAM GILBERT.
(From an electrotype medallion by E. Dunckley.)

of the magnetized needle to dip its northern end downwards. Noticing this as a circumstance that occasioned him some trouble in the construction of his compasses, he thereupon devised a *dipping-needle*, and measured the dip, "which for this City of London I find by exact observations to be about 71° 50′." He attributed both the declination and the dip of the needle to the existence of a "point respective," which the needle respected or indicated, but toward which it was not attracted. The first authoritative treatise on the variation of the compass was the tract by William Borough, comptroller to the Navy, who in 1580 found an eastward declination of 11° 15′ at Limehouse. Borough had himself travelled in northern regions, and had found at Vaigats a westerly declination of 7°, whereas by Norman's theory of the respective point there should

* Also independently observed in 1544 by Georg Hartmann, of Nürnberg, but not published till later.

have been an easterly declination of 49° 22′. The great navigators were continually bringing home fresh information. Drake, Lynschoten, Cavendish, Hariot all contributed; as did lesser men, such as Abraham Kendall, sailing-master to Sir Robert Dudley, the *soi-disant* Duke of Northumberland, and afterwards companion of Drake in his last voyage. Teachers of navigation such as Simon Stevin of Bruges, and Edward Wright, lecturer to the East India Company, might record and tabulate; but a master-mind was wanting to forge some larger and consistent doctrine which should afford a grasp of the whole subject. Such an one arose in Dr. William Gilbert. Nurtured, as we have seen, in the Cambridge which had so recently been the home of Linacre and of Kaye—the Kaye who founded Caius College—Gilbert had, during his subsequent sojourn in Italy, conversed with all the learned men of his time. He had experimented on the magnet with Fra Paolo Sarpi; he had, there is reason to think, met Giordano Bruno; he was the friend and correspondent of Giovanni Francesco Sagredo. Being a man of means and a bachelor, he spent money freely upon books, maps, instruments, minerals, and magnets. For twenty years he experimented ceaselessly, and read, and wrote and speculated, and tested his speculations by new experiments. For eighteen years he kept beside him the manuscript of his treatise, which in the year 1600 saw the light under the title of 'De Magnete,' to which was added the sub-title: 'magneticisque corporibus, et de magno magnete tellure, physiologia nova.' That which Gilbert had in fact perceived, and which none before him had glimpsed even dimly, was that the globe of the Earth itself acted as a great loadstone, and that the tendency of the needle to point in a polar direction was due to the globe acting as a whole. So he boldly put into his title-page the statement that his new philosophy was concerning *the great magnet the Earth;* and in chapter after chapter he set himself to describe the experiments upon which he founded his famous induction. The phrase *terrestrial magnetism* does not occur in any of the prior treatises, because the idea had not presented itself. Gilbert piled proof upon proof, sometimes most cogently, as when he constructed loadstone globes, or terrellas to serve as magnetic models of the Earth; sometimes with indifferent logic, as when he pointed to the iron ore in the Earth and reasoned that the magnet tended to conform to (*i.e.* turn itself toward) the homogenic substance of the body from which it had been dug. The local deviations of the compass he sought to account for by the irregularities of the Earth's crust, and maintained that the compass tended always, at places off the coast of a continent, to be deflected somewhat toward that continent. His syllogism was based on the fact that at that date all the way up the Atlantic seaboard of Europe, from Morocco to Norway, the variation was eastward. He argued that this was a universal law. But even within one generation, as may be seen in 'Purchas his Pilgrims,' in the narrative of the voyage

of Bylot and Baffin, the generality of the law was questioned. Gilbert reasoned on such knowledge as he had, and this did not include any notion of the secular changes in the declination. In his time, as he tells us, the variation of the compass at London was 11°. What he did not know was that this was a diminishing quantity which in fifty-seven years would be reduced to zero, to be succeeded by a westward declination that would last for nearly three hundred years. For the facts as known in the thirty years succeeding Gilbert's death, see the remarkable and scarce volume of Gellibrand: 'A Discourse Mathematical on the Variation of the Magnetical Needle' (1635).

A TERRELLA.

Gilbert's treatise is a skilful literary achievement, in which there is no trace to reveal whether any part was written before the rest. It is divided systematically into six books. The sixth book only appears to suffer from some incompleteness. It relates not so much to the magnet as to the Copernican theory of the universe, which doctrine Gilbert had eagerly espoused, and which he was the first in England to proclaim. It is known from a letter to Barlow, printed in 1616, that he intended to add to it certain chapters descriptive of some of his instruments, but he had not completed these before his death. The first book treats of historic accounts of the loadstone, of its origin and properties, of iron

ores in general, and of the fables and vain opinions which in the hands of Paracelsus and of the schoolmen had grown up around the magnet. The second book is on the magnetic motions, and primarily on the attractions and repulsions between loadstones, between loadstone and iron, and between magnetic needles. In this book occurs the notable digression upon the subject of amber and the electric forces of amber and of other substances which when rubbed show, as he discovered, similar electrical powers. An analysis of this part, and a summary of Gilbert's electrical discoveries, will be found in the Notes printed for the Gilbert Club to accompany the English translation (1900) of the 'De Magnete.' After this digression Gilbert returns to the attractive properties of the loadstone, and to the way they are affected by giving it different shapes. In the course of this inquiry, he announces his discovery of the augmentation of the power of the loadstone by arming it with iron caps, an invention which caused Galileo to say, "I extremely praise, admire, and envy this author for that a conception so stupendous should come into his mind. I think him moreover worthy of extraordinary applause for the many new and true observations that he has made." Gilbert further pointed out that the loadstone is surrounded by a sort of atmosphere or "orbe of virtue" within which the magnetical effects can be observed. Book III., on the directive force of the magnet, is full of most instructive experiments, in which the terrella figures largely, relating to the question how one magnet influences another and tends to make it point toward it. All this was leading up to the theory of terrestrial magnetism; for we find him naming the parts of his loadstone globes with poles, equator, and meridians. In this book he dilates on the observation that vertical iron rods, such as the finial on the Church of St. John at Rimini, spontaneously acquired magnetic properties. This he traced to the influence of the Earth, and demonstrated the effect by magnetizing iron bars by simply hammering them on the anvil while they lay in a north and south position. A crude woodcut depicts this operation. Book IV. deals with the declination, or, as it was then called, the variation of the compass. He discusses its observation and measurement, the influence of islands, the results obtained by travellers to distant parts, Nova Zembla, the Guinea coast, the Canary Isles, Florida, Virginia, Cape Race, and Brazil. Then he recounts his experiments with terrellas having uneven surfaces to represent the irregularities of the earth's crust. He points out errors arising from the fallacious practice of setting the needle obliquely under the card. He considers in separate chapters the variations in Nova Zembla, in the Pacific, in the Mediterranean, and in the Eastern ocean. The fifth book is on the dip. Gilbert seized with avidity on Norman's discovery of this effect, and devised an improved form of dipping-needle. He experimented on the dip of compass-needles placed at different points over his terrella, and evolved a theory on the proportion which he conceived

to exist between the latitude and the dip. Arguing from all too imperfect data, he propounded the view that the dip was the same in any given latitude; and proposed that seamen should ascertain their latitudes by simply observing the dip. He was aware that local irregularities might occur, as they do in the declination; but was not deterred by this knowledge from propounding his theory with much circumstance and considerable geometrical skill. After the publication of his book he developed the theory still further, and gave it to Blundevile for publication. At Gilbert's suggestion Briggs of Gresham College calculated out a table of dip and latitude. It was, however, soon found that the facts deviated more or less widely from the theory. Further observations in other lands showed the method to be impracticable, and

CAPPED LODESTONE.

Gilbert's hope to give to the mariner a magnetic measure of latitude remained unfulfilled. Book V. closes with an eloquent passage in which Gilbert affirmed the neo-Platonic doctrine of the animate nature of the universe, and asserted that Thales was right when he held (as Aristotle relates in the De Anima) that the loadstone was animate, being part of and indeed the choice offspring of its animate mother the Earth. Book VI., as already mentioned, is devoted to Copernican ideas, and contains Gilbert's one contribution to the science of astronomy, in his remark that the fixed stars (previously regarded as fixed in the eighth of the cœlestial spheres at one common distance from the central earth) were in reality set in the heavens at various distances from the Earth.

From this brief analysis it will be seen that Gilbert's claims to eminence rest not upon any particular discovery or invention, but upon his having built up a whole experimental magnetic philosophy on a truly scientific basis, in place of the vague and wild speculations which

had previously been accepted. By his magnificent generalization from the small-scale models to the globe itself, supported from point to point by experimental researches, he created the science of terrestrial magnetism. If from the imperfection of the data at his disposal he fell into sundry errors of detail, he yet founded the method of philosophizing by which those errors were in due time corrected. And if for nothing else than his masterly vindication of scientific methods, and his rescue of the subject of magnetism from the pedantry and charlatanry into which in the preceding ages it had lapsed, his memory must be held in high honour. To the names of the men who made great the age of Queen Elizabeth, who added lustre to the England over which she ruled, and made it famous in foreign discovery, in sea-craft, in literature, in poetry, and in drama, must be joined that of the man who equally added lustre in science, Doctor William Gilbert.

Alas! that of the personality of so great a man so little should be known. A brief but characteristic biography of him is enshrined by old Fuller in his 'Worthies.' The poet Dryden and the epigrammatist Owen celebrated him in still briefer verse. His portrait, which hung for nigh two hundred years in the Schools' Gallery at Oxford, disappeared a century ago, leaving only a poor engraving to perpetuate his scholarly countenance. Doubtless he is one of the four physicians depicted, by the pencil of Camden in his famous cartoon (now in the British Museum), as walking in the funeral procession of Queen Elizabeth. Of his handwriting not a vestige was known until about five years ago, when a signature was unearthed in the Record Office. Subsequently four signatures were found in the books of St. John's College; and recently there has come to light a volume of Aristotle bearing Gilbert's own marginal notes. His will lies at Somerset House; but it is only a copy. Of his fine collections of minerals and loadstones, which with his maps, books, manuscripts, and correspondence with Sarpi and Sagredo and others he bequeathed to the College of Physicians, nothing remains: they perished in the great fire of London.

In a quiet corner of the old city of Colchester stands the quaint old house where he lived, and where, according to local tradition, he once received the Queen. And hard by it is the Church of Holy Trinity, in which a mural tablet records his virtues and marks his last resting-place. But his true monument is the immortal treatise in which he laid the foundations of terrestrial magnetism and of the experimental science of electricity.

THE EXHIBITION.

A collection of books, maps, instruments, portraits and other objects, illustrating the progress of geographical science and enterprise during Queen Elizabeth's reign, was on view at the old University building on

the evening of the meeting, and remained open to inspection during the remainder of the week, being visited by large numbers, both of the

ASTROLABE. MADE IN THE YEAR 1571, WITH THE FOLLOWING INSCRIPTION: "GUALTERUS ANSCENIUS NEPOS GEMME FRISIJ LOUANIJ FECIT ANNO 1571."

Fellows and the general public. The collections of the Society were largely supplemented through the kindness of other public bodies and private owners, who showed great readiness to assist by the temporary loan of objects of interest, with the result that the exhibition was thoroughly representative of the geographical progress of the time in its various branches. The activity of the seamen and travellers of the Elizabethan age was illustrated both by the original narratives of the actors themselves, including, among others, Drake's 'World encompassed' (lent by Mr. S. W. Silver), and Hariot's and Smith's accounts of Virginia; and on the other hand by the famous collections of Eden, Hakluyt, and De Bry; while the 'First Court Book of the East India Company,' lent by the India Office, fittingly recalled the early days of British Eastern trade. The great advance made during the reign in the more scientific branches of geography, especially in the departments of navigation and nautical astronomy, was well illustrated by such works as Blagrave's 'Mathematical Jewell' (lent by the Cambridge University Library); the 'Mariner's Mirror' (lent by the Admiralty); Borne's 'Regiment of the Sea,' and Blundevile's 'Exercises.' In the field of cartography, the

most striking exhibit was the famous Mollineux globe of 1592, lent by the Honourable Society of the Middle Temple; while facsimiles of several famous maps, including that supposed to be alluded to by Shakespeare in 'Twelfth Night,' Hondius' map of the route of Drake and Cavendish, and Dudley's of Guiana, were also shown.

The contributions made by Elizabethan worthies to a topographical knowledge of our own country were well brought out by exhibits of fine copies of Saxton's and Speed's atlases, and of Camden's 'Britannia,' lent by Mr. Henry Yates Thompson; by the original (lent by the Guildhall Library) of Ralph Agas' 'Civitas Londinum,' showing London and adjacent parts in the reign of Queen Elizabeth; and by reproductions of other famous views and plans.

The collection of instruments was especially interésting as showing

A "NOCTURNAL." MADE A.D. 1572. AN INSTRUMENT FOR TAKING THE ALTITUDE OR DEPRESSION OF STARS ABOVE OR BELOW THE POLE, IN ORDER TO FIND THE HOUR OF THE NIGHT.

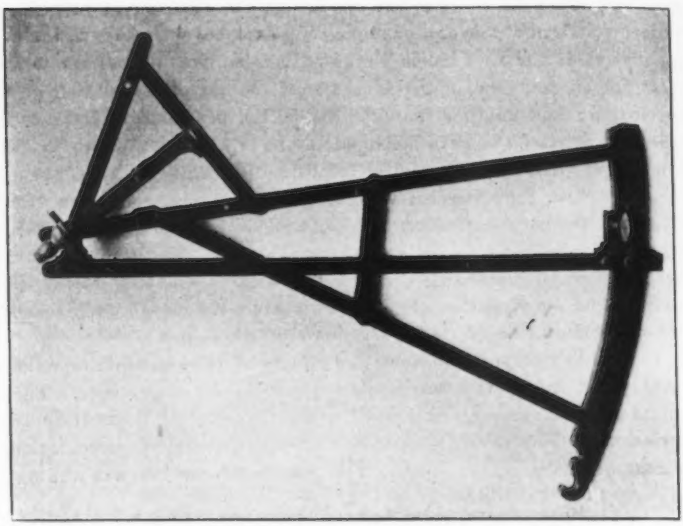
the comparatively feeble means by which the old seamen guided themselves in their perilous navigations, attaining results which are really

surprising when we think of the insufficiency of their outfit judged by modern standards. Several examples of astrolabes were shown, including that made for Sir Francis Drake before his first expedition to the West Indies, and now in the Museum of the Royal Naval College at Greenwich; and another found in the island of Valencia, Ireland, in 1845, and supposed to have belonged to one of the ships of the Spanish Armada, wrecked near the spot. Examples of 'Davis' Quadrant,' though of a later date than the Elizabethan period, gave a good idea of its prototype, the back-staff invented by Davis as an improvement on the cross-staffs previously in use for taking altitudes. Lastly, an interesting collection of dials, etc., lent by Mr. Max Rosenheim, included a finely chased set of mathematical instruments made for Queen Elizabeth by Barthelemewe Newsum, clock-maker to the Queen.

The exhibit of portraits consisted chiefly of photographic reproductions, by Mr. John Thomson, of old paintings and engravings. They included two of the Queen herself, from the original portrait in the possession of the Duke of Bedford; and copies of early representations of most of the great navigators and patrons of discovery of the age.

OUGHTRED'S HOROLOGICAL RING, INVENTED IN 1650. MADE BY NAT. WILHAM.

Among the medals and seals, those which attracted most attention were the Armada medal, struck by the Queen to commemorate the destruction



DAVIS'S QUADRANT, OR BACK STAFF, FOR OBSERVING ALTITUDES.

of the Spanish fleet (lent by Dr. Henry Woodward), and the original seals of office of Sir Walter Raleigh as Governor of Virginia, etc. (lent by Messrs. Crichton Bros., of Old Bond Street). The ships of the time were well exemplified in a picture, lent by the Society of Antiquaries, showing the embarkation of Henry VIII. at Dover in 1520, when about to meet Francis I. of France; while another interesting memento of the period was a photograph of the chest formerly kept at Chatham to hold the funds for disabled seamen started by Hawkins and Drake.

Lastly, a brief reference must be made to the interesting collection of books and other objects mainly illustrative of the work of Gilbert, exhibited by Prof. Silvanus P. Thompson. It included all the three early editions of the De Magnete, with the modern reprints and translations, as well as various other early works on magnetism and navigation, and portraits and autographs of Queen Elizabeth, Drake, and Gilbert.

The PRESIDENT: Before we adjourn to inspect the exhibition, I think you will all wish to pass a vote of thanks to the very accomplished Elizabethans who have addressed you this evening, and who have thrown so much light on the character of Sir Walter Raleigh, on the important discoveries of Sir Francis Drake, and on the valuable work of Dr. Gilbert. I may mention that the exhibition will be kept open until the 28th inst., that is, during the whole of the present week, and that it will remain in the rooms here and will not be removed to the Map Room of the Geographical Society, which is not large enough to contain it.

CHARNWOOD FOREST: A BURIED TRIASSIC LANDSCAPE.*

By W. W. WATTS, M.A., M.Sc., F.R.G.S., Sec. G.S., Assistant-Professor of Geology and Physiography at Birmingham University.

Introduction.

Charnwood Forest is situated in Leicestershire, about 6 miles north-west of Leicester, and 3 miles south-west of Loughborough. It is practically defined by a curved line joining the following villages and hamlets: Woodhouse Eaves, Cropston, Groby, Markfield, Bardon, Whitwick, Thringstone, Sheepshed, and Nanpantan. Although once famous for its slates, its chief industry now consists in road-metal, paving setts, and artificial flagstones. Some of the land is agricultural, but most of it is devoted to parks and private residences, partly because of its picturesque relief, but partly, also, because the soil is often barren, supporting only moorland and forest growth, and so can be better given over to hunting and shooting. The land is also utilized for the purposes of water-supply, and as a lung for the towns of Loughborough and Leicester, and, since the opening of the Great Central Railway, by Nottingham and other towns.

Character of the Landscape.

The most obvious feature of its landscape is the sharpness of the contrasts that it presents. While much of the lower ground is flat and monotonous, with a good soil, fertile and occupied by farms and gardens, the hills are sharp and stony, with a poor soil and a scanty vegetation; they frequently culminate in a crag or ridge with abrupt sides and a narrow crest; indeed, the walls of the crags, although of no great height, are sometimes vertical and occasionally even overhanging. Fig. 1 shows a hill with several crags, separated by a pastoral flat from a second craggy hill, from which the view was taken Again, while most of the valleys have soft and rounded contours, with alluvial flats and marshes, there are a few which are winding and gorge-like, with flanks of steep and bare rock, and with the streams running over rocky beds. Other characteristic features of the landscape will be pointed out later on.

The Two Rock Types.

The sharp contrasts above alluded to at once suggest to the geologist abrupt contacts of two very different classes of rock, and the examination of the numerous sections soon proves that this surmise is correct. The bolder scenery is found to be based on hardened and ancient Charnian rocks of pre-Cambrian age, principally volcanic in origin; the milder landscape is based on the Keuper Marl of the Triassic

* Read at the Royal Geographical Society, March 9, 1903. Map, p. 700.

System, which has long been known to rest unconformably on the older rocks. The woods, crags, and higher grounds in Fig. 2 are situated on Charnian rocks, the lower ground on the Keuper Marl.

The ancient rocks are of several types, but the dominant one is a bedded series of fine and coarser volcanic tuffs interbanded with coarse agglomerates and breccias, and passing up into conglomerates and slates (see Figs. 4, 5, and 7). These rocks are folded into an elliptical dome the long axis of which points north-west and south-east, but only the southern half of this structure is anywhere exposed. The rocks are cut by faults, jointed, and cleaved, and there have been intruded into them three or four different kinds of igneous rocks, including "porphyroids," syenites, and granites. Sometimes these are in small dykes or bosses, but at Peldar and High Sharpley (see Fig. 8), at Bradgate Park, Groby, and Markfield, and at Mount Sorrel (see Fig. 12), the masses are of considerable size, their outcrops measuring from half a square mile to nearly a square mile in area. It is these igneous rocks which are chiefly quarried for road-metal.

All the rocks are much hardened by pressure, silicification, or the formation of epidote, and as a consequence there is comparatively little differential weathering or denudation along stronger or weaker kinds. On the whole the rocks of the lowest and highest divisions are relatively weaker, while the middle division is the one which tends to stand out in a broken horseshoe of hills.

The newer or Triassic rocks belong to the upper or Keuper division of that formation. Only in the north is the Keuper Sandstone visible; if it occurs further south, it is so far underground that it has never yet been seen. The dominant covering rock in the rest of the area is the Keuper Marl or New Red Marl—a soft red clay of considerable thickness (see Fig. 3). Its basement beds, when they are seen to rest on the ancient rocks, contain a small thickness of breccia, the angular blocks having been derived from the Charnian rocks beneath; but this is rarely of any thickness. A few bands of greenish sandstone, locally called "skerry," occur here and there, generally made up of material broken from the Charnian rocks. Fig. 3, taken at Croft Hill, south-west of Charnwood Forest, shows the relation of the Keuper Marl, with its green bands, to the Charnian rocks beneath, and it also shows the basal breccias made of angular fragments denuded from the underlying series.

Unconformable Relations of the Rocks.

Thus a county in which the landscape reminds one of patches of Wales planted amongst the level pastoral country of the Midlands is proved by geological examination to be really a landscape of Welsh type *submerged under* the New Red Marl, the dominant rock of the English Midlands. Further examination shows that the cover is in many places a thick one, and that the ancient rocks are for the most

FIG. 1. The Hanging Rocks, Beaumanor Park, Woodhouse Eaves; looking S.E.

FIG. 2. Bradgate Park; Crags of Charnian Rock rising from flat Triassic ground.

FIG. 3. Croft Quarries; Keuper Marls and Breccias resting unconformably on Syenite.

Taken by permission from a photograph by Messrs. J. Burton & Sons, of Leicester.

FIG. 4. The Hanging Rocks, Beaumanor Park; looking N.W.

From a photograph by Mr. F. R. Rowley, of the Town Museum, Exeter.

part so deeply buried that only their highest points protrude through it. It has already been pointed out that the protruding parts are steep and mountain-like (see Fig. 4). Observations in the visible sections prove that these steep slopes are continued under the *cover*, and this is in accord with the experience of the quarry-owners in their attempts to obtain rock beyond the limits of the actual outcrop. It is speedily found that the amount of waste cover (New Red Marl) to be removed renders it too expensive to attempt to win the rock far from its visible outcrop. Records of well-sections collected by Mr. Fox-Strangways give further proof, for wells have been sunk a few yards away from the visible outcrop of the ancient rock without reaching that rock at a depth of many feet.

Thus the New Red Marl is actually covering a mountain system of which the summits alone are visible, while the flanks and intervening valleys are for the most part buried and filled up with the newer formation. Areas like the granite knobs of Mount Sorrel, the copse-clad crags of Bradgate Park (see Fig. 2), or the isolated rocks in the centre of the Forest about the headwaters of the Blackbrook, give examples of innumerable summits, from a tenth of a square mile to a hundred square yards and less in area, standing forth like islands from a sea of Marl. The more important ridge of Bardon Hill, the highest summit in the Forest, is closely cloaked with the Red Marl, which rises over 800 feet on its flanks. And the three much greater masses, the first extending from Peldar Tor to Grace Dieu, the second including the Outwoods, Beacon Hill, and Broombriggs, and the third the central massif round Benscliffe, while flanked with Marl to varying heights, push out many summits, shoulders, and buttresses, as well as the flanks which intervene, through the cloak.

Amongst the best localities for studying the actual unconformable relations of the cover to the ancient floor may be mentioned the following: Bardon Hill, Newhurst Quarry, Groby, Sheet Hedges, the quarries about the Brand and Swithland (see Fig. 6), and the district of Woodhouse Eaves (see Fig. 5).

Of the summits pushing out from what the map shows to be a plain of Trias around them, Shortcliffe, Longcliffe Plantation, Collier Hill, Cat Hill, Spring Hill, and those about Buck Hill, are perhaps the most striking for the actual steepness of their slopes, the boldness of their outline, and their unexpectedness when met with in the middle of the woods which have been preserved or planted round the majority of them. They are veritable peaks and arêtes, with one and sometimes two very steep sides, and often with an abrupt end. The isolated crags of Beacon Hill and Broombriggs (see Figs. 1 and 4), and those of the Hanging Rocks grounds in Beaumanor Park (see Figs. 1 and 4), those of Warren Hill and about Whitwick, are more easily seen and less closely mantled in Trias, so that they rest on their own moorland bases, which again in turn rise out of the Trias of the lower grounds.

Topography under the Trias.

At the southern slate quarry at the Hanging Rocks (Woodhouse Eaves) the abrupt drop of the ancient rock down to and under the Trias is well seen, and there is exposed in the quarry a small valley cut in the Charnian rock, and so filled up with Trias that there is no trace of it to be seen in the contour of the ground above (see Fig. 5).* Here there is also a small quantity of breccia at the junction of the two rocks.

A small abandoned and water-filled slate quarry just south of bench-mark 324, on the road from Swithland to Roecliffe Hall, shows a section of a similar valley at each end of the quarry, filled with New Red Marl. The steepness, depth, and direction of that valley are here clearly shown (Fig. 6). Traces of other buried valleys occur in the grounds of the Brand and elsewhere about Swithland, while there are others on Bardon Hill, and doubtless many more could be found in section if looked for.

Thus the study of sections actually reveals something of the character of the ancient topography underneath the Trias mantle, and shows that it is in no way different from that part which to-day protrudes above it.

It is quite evident that denudation, acting on two rocks of such wholly different hardness as the strong Charnian hornstones, slates, and igneous rocks, and the weak Trias Marl, will, so to speak, melt the latter rapidly away and leave the former comparatively untouched, at any rate for a considerable time. Now, many of the knobs of ancient rock are very tiny, only a few square yards in area, and they can only have been exposed for a very short time; indeed, some were actually entirely covered with Trias until exposed by quarrying. The latter must, of course, still have the shapes given them before they were buried up, while there can be no question that the same is almost wholly true of the tiny patches exposed during the last few centuries of ablation. Now, although the breccia at the base of the Marl bears witness to the denudation of the rocks in Triassic times, these small patches show hardly any signs of recent denudation, except just a little frost action, and little, if any, of their *débris* extends on the surface of the ground beyond their contact with the Marl. The rocks are insoluble, intensely hard, and throw off the water quickly from their steep slopes on to the surrounding Trias; hence they suffer little, and the denudation is therefore concentrated on the Marl, particularly along its contact with the older rock. Thus the patches gradually grow in area and height by the ablation of the surrounding Marl.

To a great extent, this is also true of such of the larger patches as have been wholly buried. The actual amount of denudation they have suffered since the Trias was removed from them is very small indeed.

* Bonney, 'The Story of our Planet,' p. 418.

FIG. 5. Slate Quarry, The Hanging Rocks, Woodhouse Eaves
Valley in Slates filled with Keuper Marl.

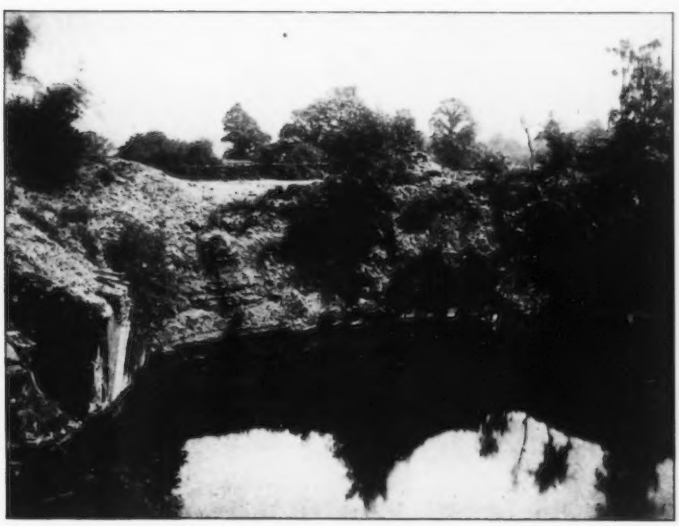


FIG. 6. Slate Quarry near the Brand, near Swithland. Charnian slates can be seen to the left and rising above the water to the right. The vegetation between covers the Trias Marl, filling an old valley.

They show no signs of glaciation, and their peaked and jagged character, though doubtless slightly accentuated since they were uncovered, would seem to be that which they possessed when originally covered up by the New Red Marl (see Fig. 7).

A Triassic Landscape.

If this is a correct interpretation of the evidence yielded by the character of the unconformity where seen in quarries and mapped upon the ground, the landscape presented by those parts of Charnwood Forest which are made of the ancient rocks had its present character in Triassic times. It is, indeed, a *Triassic landscape* which is now being uncovered again or "developed" for our inspection, and we are at liberty to use it to picture to our minds the appearance of this part of England in Triassic times (see Fig. 8). And we are further at liberty to follow the idea out to its logical conclusions.

History of the Landscape.

The Trias was a period of desert, salt lake, and intra-continental conditions, and we may think of Charnwood as being, at that date, like the mountains in the neighbourhood of the Great Salt Lake desert, which now lie partly buried up under the sediments of the ancient Lake Bonneville.* The presence of the Keuper Sandstone over part of the Charnwood area and its absence in other parts seem to show that, though almost, if not quite, buried under the Keuper Marl, many of its mountains and ridges stood out of the desert in which the preceding Keuper Sandstone was laid down.

Lower Trias and Permian rocks are absent from the area; but the neighbouring Permian Breccias of Leicestershire have been shown by Mr. Horace Brown † to contain fragments such as might have been weathered off the Charnwood mountains in Permian times.

The Coal-measures flank the west of the Forest, and rest directly and unconformably on the Charnian rocks; and the small patches of the earlier Carboniferous Limestone at Breedon and Grace Dieu, with their dolomitic character, seem to prove that, though the higher peaks emerged at this date, the lower flanks of the range were encroached upon by the sea. Indeed, the Charnwood mountains would appear to be the north-easterly extension of the well-known land-barrier or barriers which extended across the Midlands from Wales in early Carboniferous times, and were not even completely submerged in late Carboniferous times.

As the bases of the mountains, at any rate, were being submerged in Carboniferous times, the date of their actual structure and emergence

* Gilbert, *Second Annual Rep. Amer. Geol. Survey*, p. 169.

† *Quart. Jour. Geol. Soc.*, xlv., 1889, p. 1.

as mountains must go back to earlier times. How far back we cannot say, but the next earlier period, that of the Old Red Sandstone Period, was a time when much of Britain was lofty land interspersed with broad lakes. As no Old Red Sandstone or Silurian rock is known nearer than South Staffordshire, and no visible Cambrian nearer than Nuneaton, it is not possible to deal with the Charnwood area at these periods.

This, however, we do know. The ancient rocks are of pre-Cambrian date. The first earth-movements to which they were subjected are amongst the earliest of which we have any knowledge in Britain; they have movement-structures which make the Cambrian rocks of Nuneaton look young beside them. We cannot possibly suppose that they were elevated into a mountain range later than the post-Cambrian period, and they may very well have had their structures impressed upon them much earlier than that. It is by virtue of these structures that they constitute a mountain range. We may therefore, without prejudicing our right to go back, should newer discoveries warrant it, to still earlier dates, confidently state that at whatever period the mountains were actually formed, they must have stood high above the land as a great range in Old Red Sandstone times, and that they could have received much of the earth-sculpture which shaped their details at that period.

Explanation of Characteristic Features.

Amongst the characteristics of the sculpture there are two noteworthy features. In the first place, there are no escarpments and very little differential denudation; indeed, nearly all the exposed ridges are *plagioclinal*, and at Collier Hill, Beacon Hill, Broombriggs and elsewhere not only are the rocks seen to strike obliquely across the ridges as a whole, but even the smaller crags are plagioclinal too (see Fig. 9). One or two features—Ives Head, for example—look so much like escarpments that they might be photographed as such, but an examination on the spot shows that they have no escarpment structure. This seems to indicate that at the period of sculpture the rocks had been so hardened that they were all about equally strong and they all resisted equally. They were also cleaved and jointed, and the planes of these structures, together with the marked bedding surfaces, gave the guiding directions to denuding forces. Such sculpture might very well have been effected under Old Red Sandstone conditions, when the mass was cut up by rapid streams into fiord-like valleys separated by ever-sharpening ridges and arêtes.

In the second place, ridges are often cut off without any apparent reason, rather after the manner of the sea with capes and headlands than of transverse streams (see Figs. 1 and 4); hence it is possible that, after subaërial sculpture in Old Red Sandstone times, there may

FIG. 7. Broombriggs, near Woodhouse Eaves. Crags of indurated volcanic tuffs.

FIG. 8. Summit of High Sharpley. Cleaved porphyroid.

FIG. 9. Summit of Broombriggs. A plagioclinal ridge.

have been marine erosion of the ridges into islands in the Carboniferous sea, evidence for the encroachment of which has already been given.

Next came the probable re-elevation of Permian times and the weathering which contributed to the distant Permian Breccias, and then the desert and "Lake Bonneville," conditions of the Trias, the deposits at first only reaching the lower roots of the range, but gradually encroaching higher and higher as the lake deepened or the desert sands thickened in the fashion described by Captain McMahon in Baluchistan.* Further reference to this phase is reserved for the conclusion of this paper.

The general character of landscape blocked out in Old Red Sandstone times and modified in the Carboniferous Period was retained and accentuated by the Triassic weathering while the lower flanks were being covered; and finally, at the end of the Triassic Period, the rapid deposit of the Marl, whether from water or air cannot yet be satisfactorily determined, buried up many, if not all, the summits of the area, and laid them up with all their latest characters in lavender, as it were, to be gently unwrapped and reverently studied in modern times.

Whether or no the Triassic covering was complete up to the highest summits, the writer has not been able to determine from observations yet made. The fact that no streams cross the Forest, but that all of them rise within it, and mostly about the central and highest parts, is in favour of the view that certain of the knobs are "monadnocks," which have always remained undestroyed and uncovered. It might be argued that a similar result would be likely to follow from the general ablation of the country. Certain characters of the modern streams are, however, against this view, as will be seen later.

The area may be regarded as closed, and covered up completely during the Jurassic and Cretaceous times. Of its condition in Tertiary times we have no evidence. Whether originally covered completely or not, it is quite certain that some parts of the ancient rocks were open in the Glacial Epoch, for blocks of Mount Sorrel granite and other Charnwood rocks occur as boulders in the neighbouring districts, and boulder-clays nestle against the granite itself in many parts of the Mount Sorrel area. But while this is undoubtedly true of the outer and higher summits, the writer inclines to the belief that much of the ablation which laid bare the summits of second and third importance did not reach them till after the Glacial period.

Redevelopment and Superposed Drainage.

The general character of the geological map of the country, and particularly the old edition of the Survey geological map, which allowed a larger area to the ancient rocks and a smaller one to the

* *Quart. Jour. Geol. Soc.*, liii., 1897, p. 289.

Trias than has been proved by Mr. Fox-Strangways to be actually the case, shows that the Trias fills fiords which run in the direction of the structure of the country, generally in a north-west and south-east direction. The following may be mentioned as important and obvious: the Upper Blackbrook fiord, the Shortcliffe fiord, the Alderman's Haw fiord, the Ling Dale fiord, and the Ulverscroft fiord. The scenery of these fiords is very striking, particularly as they are traversed by some of the more important longitudinal roads of the district. They are also generally occupied by streams during part of their course. This, of course, is only natural. For the reasons already given, after ablation had exposed any of the ancient rock, water would tend to flow along the junction of the ancient rock and the Trias, and to erode its course along that junction. Little by little the Trias area would be lowered, and the tendency would be to gradually empty the Marl out of the old fiords, and to dissect out the fossil landscape. In the centre of the district, where the old summits stood high and the Trias mantle was thin, this would obviously occur, but the streams would then pass outward to the flanks, where, however, the Trias was increasingly thicker. Here there would be nothing to guide the streams. If they began to wander at all and incised their courses deeply in the Marl, there would necessarily be many places where they would depart from the ancient topography, and they might come upon buried masses or ridges of ancient rock, which they would be then compelled to deal with. In the former case the mass would be skirted and "developed" by the stream, as Shortcliffe has been picked out in the course of the Shortcliffe brook, or the Rock Villa crags developed by the Upper Blackbrook. In the latter case the ridge must be cut through, and a gorge would necessarily be carved out by the stream which had "lost its way." There is hardly a stream in the Forest which does not do this, and the consequence is that, while it is cutting its transverse gorge, the slack stream behind it, having reached a temporary base-level, has never been able to empty the old fiord of its contents of Trias Marl. The following examples of transverse gorges, cut as escapes at the side of partly emptied fiords, will be noticed on consulting the map:—the Ingleberry gorge on the Shortcliffe Brook; the Whittle Hill and Forest Gate gorge on the Wood Brook (Alderman's Haw fiord); the Brand gorge at the foot of the Ling Dale fiord (see Fig. 10); the very striking Bradgate Park gorge at the foot of the Ulverscroft fiord; and the Grace Dieu gorge, cut by a brook which rises in the hollow north of Bardon Hill, escapes from the Forest for a time, skirts it through Whitwick and Thringstone, and then doubles back through Grace Dieu Woods in a picturesque little valley.

The marked exception is the Middle Blackbrook, the course of which, being mainly north-westward and northward, has not so far encountered any ridge of buried Charnian rocks. In consequence of this, it maintains throughout a considerable fall, and has scooped the Trias right

FIG. 10. Cuckoo Hill, the Brand, near Swithland. A transverse gorge cut by a stream escaping from the side of a partly emptied Triassic fiord.

FIG. 11. Blackbrook. An emptied Triassic fiord.

out of the fiord in the middle part of its course, and exposed to our view a valley unique in the Forest—steep sided, winding, rock bound, and extremely beautiful (see Fig. 11). Although the modern stream must have unquestionably deepened and somewhat altered the outline of the old rocks in this valley when it did meet with them, there can be little doubt that the main outlines and character date, like the rest of the landscape, to pre-Triassic times. And it is interesting to observe that the Blackbrook valley, in its outline and character, recalls rather strikingly the deep-cut "gutters" and "batches" as they are called, in the Shropshire Longmynd, where the rocks are of similar character and presumably of about the same age as those of Charnwood.

Relief in Triassic Times.

The interest aroused by these topographic questions in the writer's mind suggested the possibility of constructing a map of the outline of Charnwood Forest as it existed in Trias times. The outlines of the Trias were therefore inserted on the contoured 1-inch map of the Forest, and new contours were drawn to express the heights at which the Trias had been mapped in contact with the ancient rocks. Unfortunately, the information failed where it was most needed—where the Trias became thick and the ancient rocks were deepest underground; but some important points came out clearly. The ancient rocks were found to show at the surface at three classes of places; (1) the hilltops, where the general ablation had melted away the Trias so as to expose the highest points of the old Charnian range; (2) where the superposed streams, following the old fiords, had cut down sufficiently deeply to "develop" the ancient Triassic topography; and (3) where the superposed drainage had "lost its way," and, after traversing an old fiord for some distance, had turned aside and cut across ridges formerly buried under the Trias.

This map, confessedly an imperfect first effort, is given as an attempt to delineate roughly the general outline of the country in Triassic times. It shows, as might be expected, that the Triassic topography is for the most part on the same lines as the existing topography, but more pronounced; the hills steeper, the valleys deeper, and the general plan, on the whole, rather simpler. But it also shows that, so far as they can be followed, the outlets of the old fiords depart very considerably in many cases from their present outlets; and it also indicates that as erosion proceeds, not only most, but all, of the streams will probably realize that in attempting the dissection of the old topography, they have often, like an inexperienced surgeon, chosen to cut in directions which will give them a great deal of trouble because they are not consistent with the underlying anatomy.

It may be pointed out here that this want of exact adjustment in the superposed streams may be used as an argument that the very highest summits of Charnwood have always remained above the Trias,

or else the adjustment of the heads of the stream-system to the highest Charnian summits would not be likely to have occurred.

Wind Erosion.

It may well be expected that a landscape which dates back to Triassic times, and which ought to have received the finishing touches of its sculpture at that date, should bear some hall-mark. It has been the good fortune of the writer to find this, but as the discovery has been notified elsewhere,* and will be more fully described at a later date, a short reference to it must for the present suffice.

It has been long known that the granite of Mount Sorrel, when "unbared" for quarrying, frequently shows a rounded, smoothed, and terraced surface. As this surface was first discovered and photographed in contact with Boulder-clay, it was not unnaturally attributed to glaciation. Quite recent excavation at Mount Sorrel (see Fig. 12), Hawcliffe and Nunckley Hill have, however, exhibited the surface in contact with New Red Marl, the basement layers of which were made of fragments of disintegrated but undecomposed granite. Knobs, projecting upwards in a way which would be impossible under ice, have been found by Mr. Teall; while the section at Nunckley Hill showed that the ice which deposited the Boulder-clay there had been unable to scrape away a thin skin of New Red Marl which remained between the terraced granite and the boulder clay.

The terracing and smoothing might perhaps be explained by wave-action, but the fact that the granite surface is perfectly fresh and undecomposed is in favour of the existence of a dry climate while the covering Marl was being deposited. Further, in the immediate neighbourhood of one of the most characteristic junctions of granite and marl there were found first one and then several examples of highly polished granite, not *in situ*, but obviously derived from about that spot, with the peculiar irregular and glazed surface which is only known as the product of wind and sand erosion. These specimens have been shown to those familiar with desert-wind erosion, and they have unhesitatingly stated their belief that wind charged with sand must have been the agent operating on these specimens of granite.†

It seems, therefore, legitimate to conclude that the Mount Sorrel granite was exposed to the sand-blast of wind-erosion in the earlier Triassic times, and that it acquired its characteristic smoothness and polish, and perhaps its rounding and terracing, as the result of wind-erosion in the Triassic deserts, before it was finally buried and sealed up under the New Red Marl.

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* Report of British Association, 1889, p. 748; and *Proc. Geol. Assoc.*, vol. xvii., 1902, p. 373.

† See also La Touche, *Mem. Geol. Survey of India*, vol. xxxv. pt. i. p. 9 and pl. i.; and Bonney & Hill, *Quart. Jour. Geol. Surv.*, xxxiv., 1878, p. 230.

FIG. 12. Mount Sorrel, Charnurd Forest. Smoothed and terraced granite covered by Keuper Marl.

From a photograph by Mr. P. W. M. Wright; block lent by Dr. H. Meadows.

Conclusion.

The writer would like to point out that, although the conclusions brought out by this paper are essentially of a geographical character, the whole of the observations and the methods of drawing conclusions from them are the outcome of geological work and the geological method. This paper is an illustration of the mutual obligation of the two sciences to each other.

The relations of the Charnian and Triassic rocks in the forest have been known to geologists since the work of Sedgwick and Jukes. They were mapped on the old edition of the map of the Geological Survey, and referred to by Bonney and Hill in a series of papers to the Geological Society and elsewhere.

The outlines of the areas of ancient rock defined in the maps is the work of C. Fox-Strangways, Esq., F.G.S., executed for the revised map of the Geological Survey. The conclusions of the author are largely the outcome of observations made during the study of the Ancient Rocks of the Forest, also carried out for H.M. Geological Survey, though some of the observations, and a good many of the inductions, are the result of work executed since he ceased to be a member of the Survey staff. The geological information on the two maps which accompany the paper are presented here with the permission of J. J. H. Teall, Esq., the Director of the Geological Survey. Of the photographs reproduced, the majority are from negatives taken by the author, but No. 3 is the work of Messrs. J. Burton & Sons, of Leicester; 4, of Mr. J. R. Rowley, of the Exeter museum; 7, of Mr. W. Jerome Harrison; 8, of Mr. P. H. Levi; and 12, of Mr. P. W. M. Wright. The block from which the last is printed has been kindly lent by Dr. H. Meadows, of Leicester.

Before the reading of the paper, the President said: I think we shall all agree that there is as much that is interesting to geographers in our own island as there is in any other part of the world between England and the Antipodes, and therefore I believe that I can promise you an extremely interesting paper from Prof. Watts this evening. I now ask Prof. Watts to read his paper.

After the reading of the paper, the following discussion took place:—

Prof. Bonney: Geologists are supposed to be about the most quarrelsome of people, so I suppose I have been called upon in order that I might fall foul of Prof. Watts's paper. But in regard to that there are two difficulties—one, that although my friend, Mr. Hill, and I were working at that region so long ago as the later sixties and the earlier seventies, when I suppose Prof. Watts had not yet left school, and that very fact brought him up to Cambridge and enabled us to enter into such very pleasant relations there as teacher and pupil, I always find myself with an unconquerable prejudice in favour of everything he does and says; and the other is that I really have no objection to make. When we were at work in this region we directed our attention chiefly to the nature of the Charnwood rocks themselves, and only incidentally noticed their superficial features. But in my old note-books I have sketches of these very valleys which have been shown to you on the screen to-night, and I can remember in one place where, in an exceedingly pretty glen,

there were fragments of the old Keuper marl still sticking to the Charnwood rocks which Prof. Watts has described to you to-night. We dwelt lightly upon it then, because we were not at that time directly concerned with it. You have exactly the same thing in a district to the south and south-west, and I may quote one instance from that to show you how curiously concealed some of these buried hilltops are. There is a quarry worked between Narborough and Croft Hill, which was concealed until a very few years ago, and certainly, from all I could ascertain, in some parts could not have been more than 3 or 4 feet underground. But judge of my astonishment at my last visit to find that they had opened new quarries where I remembered ploughed fields, and where there had not been a trace of rock visible in those parts. It seems to me that there is no question that Charnwood is a piece of fossil geography which has been preserved to us like one of the mummies in an Egyptian tomb, from which Nature has quite recently taken off the protective cover under which it was buried long ago. With regard to this protective cover, whatever may be the most novel idea, I confess I do not know what ground there can be for that alternative view which Prof. Watts put forward. I do not understand how to get from wind-action so extensive a deposit, or one with salt and gypsum; but let that pass. I have noticed some of those features to which Prof. Watts called your attention in the later part of his lecture, but I never saw any case of that peculiar surface on granite in contact with the Keuper marl itself. Those I saw were always in contact with the glacial drift. A very common type of them is something like a ploughed field, with the top of the ridges worn away, and I thought this probably had been produced by slabs of ice grinding upon the shore, and I used it to show that there was no true glacier-worn rock in that district. Those sections were not uncovered when we were there; and with regard to that photograph of the fluted rock, unquestionably that is due to the action of sand driven by the wind, for it is curiously like a specimen which I collected years ago in the neighbourhood of Burntisland. There a little lump of basalt, 3 or 4 feet high, stuck out from the sand, and it was fluted in the same curious spoon-like grooves, the grains of sand impinging on it and scooping out by degrees one of these long hollows; so I have no doubt Prof. Watts is right in saying that the desert-born sand, before the great Salt lake formed, produced these singular surfaces on some of the hills of Charnwood Forest. We have here, then, a piece of fossil geography that goes back to a time so remote that mammals then were only just beginning to make their appearance upon the face of the Earth.

Mr. H. J. Mackinder: In common, I imagine, with every one in this room, I listened with the greatest admiration to Prof. Watts's lecture. There was one point at the end of it upon which it may perhaps be desirable to say a word or two. Prof. Watts pointed out that this lecture of his illustrates the exceedingly close connection between geography and geology. In fact, I have heard one or two criticisms to the effect that this was a geological and not a geographical paper. The position, I think, is certainly what he claims, that in the most beautiful manner this study illustrates the close connection between geography and geology, and also the distinction between them. Some years ago I ventured to suggest as a formula for the expression of that distinction, that the geographer looks at the past in order that he may understand the present, and the geologist at the present in order that he may understand the past. You will notice that Prof. Watts borrowed from the geographer for the purpose of proving that sand had smoothed the surface of certain rocks; he took expert opinion from those who had seen the action in process in the deserts. Prof. Watts comes back to us to-night and repays with interest the loan which he had thus taken from the geographer, by presenting to us a vivid conception of the present surface of the land, and explaining the fact

that that surface is in the main the rock mantle of an old landscape whose peaks alone now penetrate to the air. Such a conception is valuable both to geologists and to geographers, but from it they start in two different directions: Prof. Watts goes back to the old Triassic conditions to realize what was then the physical geography of the land, whereas the geographer will tend to be drawn forward and to picture to himself the wide expanse of the Triassic marls of Leicestershire and Warwickshire overgrown until recently with the great forest of which Shakespeare's Arden was part, and will then realize how the Romans constructed their neighbouring Watling Street, bringing from these unsheathed summits of an ancient landscape the material wherewith to make roads over the fertile marl surface of the country around. It is no unimportant fact that the marls of central England were laid down upon this worn rocky surface, for in Russia and in Hungary you have large expanses of soft rock which waited until these railway days to be developed agriculturally, because there was no hard rock rising through a softer mantle to furnish materials wherewith to construct ordinary roads. It is for this, among other things, that some of us have been struggling in the reform of geographical education. We ask those who have to base economic and political geography upon physical geography not to be content with the surface, but to take over from geology such an account of the structure as an artist must obtain if he wishes to understand sympathetically the outer curves of the human body. We and the geologists are in part studying the same material. The tendency of the geologist is like that of the historian, to study the past; the tendency of the geographer is precisely like that of the political philosopher—he looks at the current forces shaping the destinies of the world, but requires history to explain the facts. Such distinctions are not very important to the researcher. As Prof. Watts has said, he has obtained some geography as a by-product of his geological research. The researcher is careless of the boundaries, which must, however, be jealously considered by the organizer of academic studies. I venture to say, sir, that Prof. Watts's paper has most admirably illustrated both the closely cognate character of geography and geology, and in the most repeated manner the contrast in their points of view.

Dr. Blanford: I rise in accordance with your request, but I do not know that I have very much to add to what has already been said. I am afraid that to those who have been accustomed to geography in its narrow sense, it may appear that this paper is rather different from what we usually have. I think that when we turn to these formations of which we have had a very curious instance given us to-day, we shall find much worthy of study, and, so far as we have gone, I may say that the uniformitarian theory seems to be wonderfully supported. All the details of this very remarkable landscape in the centre of England agree marvellously with those which we find in different parts of the world at the present day, and it is a matter of great interest and of great importance that we should be able to obtain so good a record of ancient landscape as in this case, because, as every geologist knows, the old surfaces underlying modern deposits are generally so much decomposed, that it is impossible to restore their contours with any degree of accuracy. And there is another interesting point connected with the facts Prof. Watts has so well put before us. Certainly the land itself has changed, but where was the Atlantic ocean? It is difficult to conceive of a country in this latitude with the Atlantic ocean in existence, and also with the intensely dry atmosphere that must have existed in order that the very peculiar form of desert landscape could have been developed, and this, I need scarcely remind you, is entirely in accordance with the views that are held by some of the foremost geologists of the present day.

Mr. G. G. Chisholm: I am afraid at this hour it would be very injudicious of me

to intrude with any lengthy remarks upon the paper we have heard, and any such remarks would be very unwelcome. But I will at least take the opportunity of expressing the pleasure that I have felt at being present at the reading of the paper, which, as Mr. Mackinder has described, belongs to the borderland of geography and geology. As the writer of the paper himself states, the methods of investigation in this paper are wholly and distinctly geological, but the results, nevertheless, are of peculiar interest to the geographer.

The PRESIDENT: The meeting, I am sure, will wish to thank Prof. Watts for the very interesting and to us very original paper that we have listened to with such pleasure to-night. Mr. Mackinder has admirably stated the occasions when geographers must study geology in order that they may understand the physical aspects of a particular region, and this has been well shown us by the paper that we have listened to this evening. I have now to propose to you a vote of thanks to Prof. Watts for his paper, and I am sure you will pass it with acclamation. Mr. Mackinder also pointed out to us the occasions when geographers must turn to history for help. I mention this because at our next meeting on March 23 I propose that we should not forget the occasion of the death of Queen Elizabeth, for during her long and admirable reign there were the beginnings of every department of our science. It was then first that explorers, both by land and sea, traversed almost every part of this Earth; it was then first that we began to understand cartography and to engrave maps; it was then first we began to have instrument-makers, and to improve upon the older instruments used; and, to a great extent, it was then that we first published atlases. Then first we published a great collection of voyages and travels. It was then first that we began our magnetic observations; indeed, it was that period in which were the beginnings of every branch of geographical science, and I therefore thought we ought not to pass that time without some notice, because it is good to look back and to remember those from whom we have inherited all we now know. I propose that, in addition to reminding ourselves of the work of our predecessors of that time, we also have a small exhibition of their instruments, their maps, and their books, in order that we may impress upon our minds the great work that was done during that long and memorable reign.

THE CARTOGRAPHY OF SPITSBERGEN.*

By Sir MARTIN CONWAY.

IN the following article I do not propose to enumerate or discuss all the maps of Spitsbergen that may have been published between the time of its discovery and the commencement of the scientific exploration of the archipelago, but only those which I have been able to come across in a careful but not exhaustive investigation. There must have existed a great number of maps which I have been unable to trace, especially English maps, some of them of high importance. Many are probably lost beyond recall, the most important gap, as we shall see, being the

* Map, p. 700. For other reproductions of old maps of Spitsbergen, see vols. xv., pp. 129 (Barentsz's map, 1598); 129 (Hondius' map, 1611); xvii, 629 (Daniel's map, 1613); 625 (Joris Carolis' map, 1614); xiv., 157 (Purchas' map, 1625); xvii., 631 (Joris Carolis' map, 1634).

records of the later explorations made on behalf of the Muscovy Company.

The earliest map of all is, of course, that known as Barentsz', inscribed 'Auctore Wilhelmo Bernardo,' and dated 1598. It was a posthumous publication, and the best that can be said of it is that it may have been drawn from materials left by Barentsz. A passage in De Veer's 'Three Voyages' must, however, be recalled, in which he describes how, just before Barentsz died, he "looked at my (De Veer's) little chart, *which I had made* touching our voyage, and we had some discussion about it." It is scarcely possible to avoid the suspicion that this may be the draft that was published as Barentsz'. It appeared for the first time in 1599, in the second part of the abridged Latin edition of Lindschoten's *Itinerarium*, published by Cornelius Claesz.

In this map there is an extraordinary blunder. The west coast of the island, which lies, in fact, almost in a straight line, north by west, is represented as bent at right angles, so that the part of the coast above the Foreland trends east-north-east instead of west-north-west, the direction of the part south of the Foreland. How the blunder arose we cannot now say; possibly from some written note in which east was set down (as not seldom happens) by mistake for west. This error was remarkably persistent. It is found on all sorts of maps, long after more correct and detailed surveys had been made, and it even infects such surveys. Thus, for instance, though Vischer's world-map of 1639 shows Spitsbergen fairly correctly, as then known, the younger Vischer, in his world-map of 1657, returns to the old Barentsz type of sixty years before.

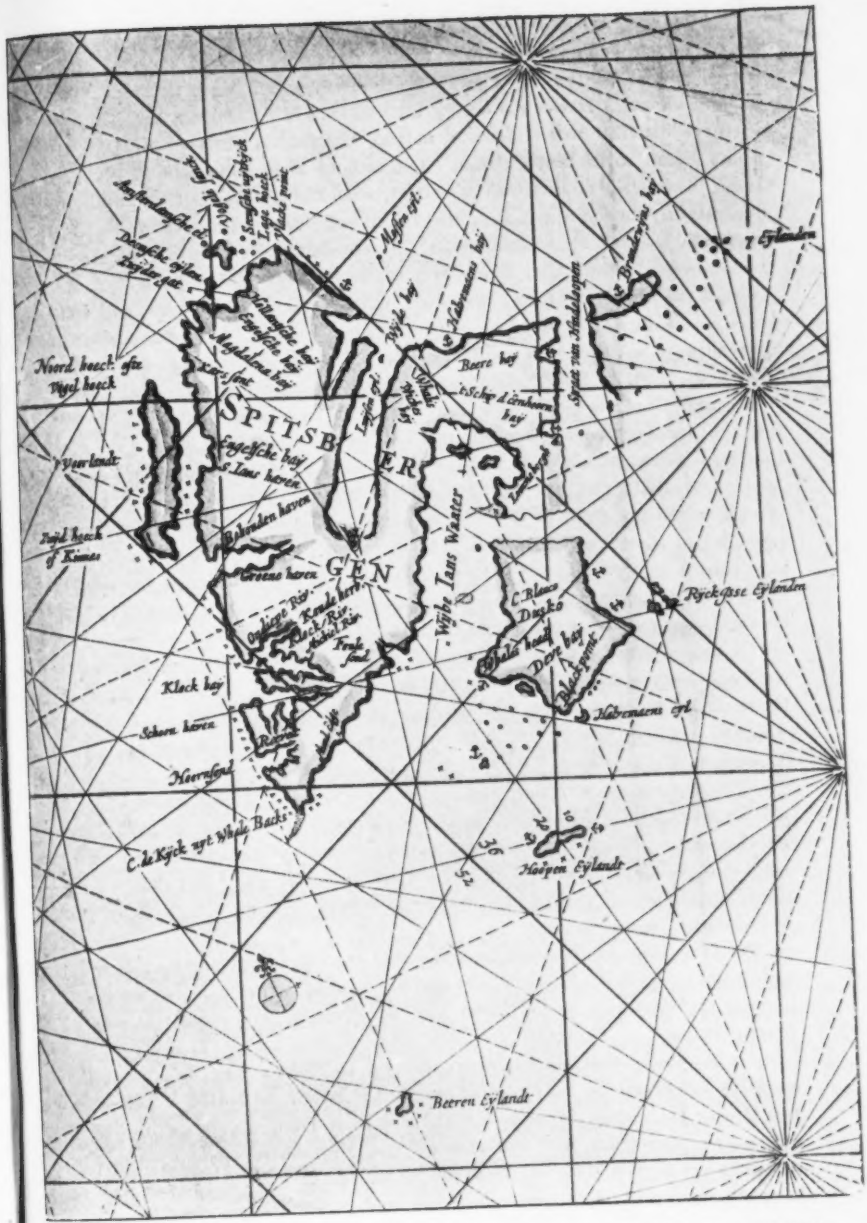
In the years immediately following the discovery the Barentsz type, of course, held the field. We find it on Franciscus Hoeius' map of the world of about 1600, in the Bodel Nyenhuis Collection at Leyden; and we find it on Wright's (commonly called Hakluyt's) map of 1600—"the new map" of Shakespeare's Twelfth Night. It appears, also, on the second state of Gerardus Mercator's map of the North Polar Regions, and on the Molyneux Globe in the library of the Middle Temple. It was used with little change by Jodocus Hondius in his History of Amsterdam (1611) and the Arctic map in 'Recentes Novi Orbis Historiæ' (Coloniæ Allob., 1612). It even appears on the globe engraved by Abraham Goos and published by J. Janssonius at Amsterdam in 1621, though in 1620, as we shall see, the same A. Goos had engraved a far superior map of Spitsbergen. In 1625 it was still the best representation known at Dieppe, where Jean Guérard published it as "Terre de Nieuwe Landt," in his 'Nouvelle Description hydrographique de tout le Monde.' It reappeared again and again in editions of Mercator's Atlas down to 1633, and even in 1657, as we have seen, it was still to the fore.

The first fairly truthful draft of the west coast was the chart known

as John Daniel's. The Muscovy Company from the first caused surveys to be made of the coasts explored by their servants, but they seem to have endeavoured to keep these surveys secret. Their expedition of 1611 did a good deal of exploration. Next year the first Dutch whaling ship went to Spitsbergen, under the command of Willem Cornelisz. van Muyden, piloted by an English deserter named Allen Sallowes, "a man imployed by the Muscovia Companie in the Northerne Seas for the space of twentie yeeres before; who, leaving his country for debt, was entertayned by the Hollanders, and imployed by them to bring them to Greenland [Spitsbergen] for their Pylot." Daniel's chart doubtless went over to Holland in Sallowes' pocket. Who Daniel was we do not know, but as the chart includes the Muscovy Company's discoveries of 1611, Daniel probably took part in the voyage of that year.

This chart was first published in 1613 by Hessel Gerritsz. at Amsterdam, in his polemical tract, entitled 'Histoire du pays nommé Spitsberghe,' where (p. 12) the following reference is made to it: "avons suivy pour la plus grand part les annotations des Angloys, tirés d'unne carte de Johan Daniel, escrite à Londres, l'an 1612." In this first edition of it most of the names are those given by the English. The next version of it, in which the names are those used by the Dutch, is that already referred to as engraved by A. Goos in 1620. It was drawn by Harmen and Marten Iansz of Edam, and published at Amsterdam in 1621 by Ian Eversz. Cloppenberg. The only example of it ('Nieuwe Pascaerte van . . . Europa') that I have seen was in Baron Nordenskiöld's collection, and has passed with it into the library of the University of Helsingfors. In addition to the west coast, as depicted by Daniels, it shows a small part of the north and east coasts, the mouth of Wybe Jans water, Swarthoeck away to the east, and Hope island south of it. That Swarthoeck was the south-west point of Edge island and on the east shore of Wybe Jans water, was not realized by the Dutch for a good many years. As late as 1660, when Edge island is well depicted (as in Arnold Colom's chart), Swarthoeck is duplicated as a separate island further away to the east.

The Dutch clung to this type also long after far better charts had been published. The original Daniel of Hessel Gerritsz. reappears in 1622 on a large terrestrial globe by Guljelmus Caesius, of which I found examples at Venice, in the Doge's Palace and the Correr Museum. We next find the same type, a little further developed, on a manuscript chart of 1628, drawn by Jean Guérard of Dieppe, and now preserved at Paris in the Département des cartes et plans de la marine (Pf. 2, div. 1, p. 2). Then Joris Carolus, in 1834, introduced it, with a slight extension of the north coast, into his 'Het nieuw vermeerde Licht' (Amsterdam: Map 22, p. 147). In the following winter Vrolicq freely copied it on a vellum chart, which he used to illustrate his case against the Dutch. The corresponding Dutch case was supported by a large manuscript



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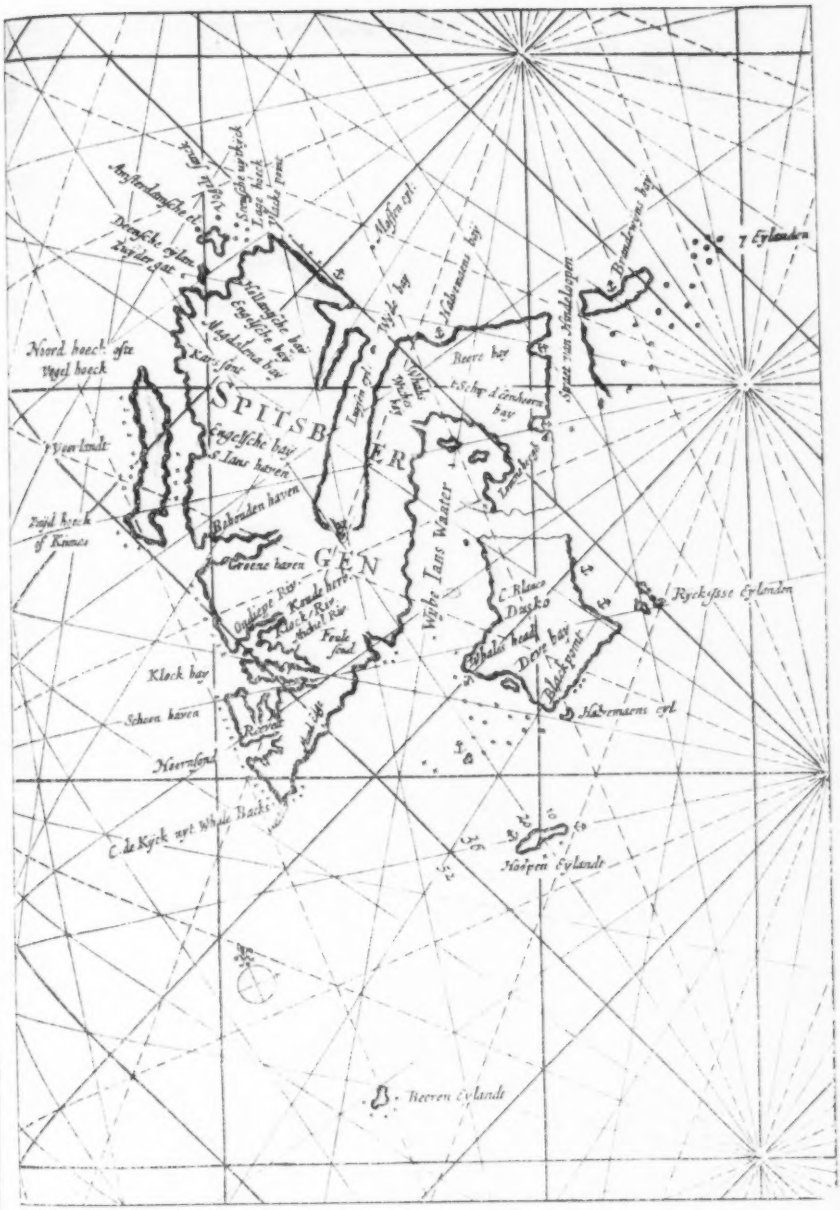


PASKAERT VAN SPITSBERGEN MET ALLE ZIJN ZEEKUSTEN ZOO VEEL TOT NOCH TOE BEKENT IS.
BY HUNDRICK DONCKER. 1663.

chart, which belongs generally to the developed Daniel type of the period, but presents many small divergencies which were not repeated in later charts. It was drawn by Michiel Hsz. Middelhoven, and is now preserved in the Rijks Archief at the Hague. A number of Dutch pilots swore to its truthfulness. Let us hope they have been forgiven. Isaac Commelijn copied Daniel's chart, with the addition of mountains decoratively dotted about, into his 'Begin ende Voortgangh vande Nedelandtsche Oostindische Compagnie' (Amsterdam, 1644), and in so doing remembered to state that Daniel was his authority. Next year the same type turns up in Anthony Jacobsz.' edition of Carolus' atlas, and in 1648 in Jacob Aertsz. Colom's 'Der Vyerighe Colom' (Amsterdam), and it reappears in other publications of Colom's, printed and manuscript,* down to 1654. Other Amsterdam publishers made use of it—Pieter Goos and Cornelis de Leeuw in 1650, in a Pascaert (Brit. Mus. 982 (13)); Janssen, in another almost identical (Brit. Mus. 982 (11)); Willem Iansz. Blaeu, in his 'Zeespiegel' (Amsterdam, 1652, chart No. 48); and finally, as late as 1703, in the English translation of Constantin de Reneville's 'Voyages.' Such is the vitality of a cartographical type when once firmly established!

The Muscovy Company's servants no doubt brought home surveys year after year, but they have all disappeared save part of one. This is the lower half of a manuscript chart of the west coast, surveyed in 1613, apparently by R. Fotherby, and now preserved with his journal in the library of the American Antiquarian Society at Worcester, Mass. It is more accurate than the corresponding portion of the so-called Edge's map. Probably it went into the archives of the Muscovy Company, but it does not seem to have been given to the public.

The same Joris Carolus, who in 1634 published Daniel's chart with all its omissions to the eastward, had himself in 1614 explored the south coast of Edge island, and made a manuscript chart of it, which may still be seen at Paris in the Depôt des cartes et plans de la marine. This type was not reproduced, so far as I have been able to discover, not even by its own parent.

We now come in chronological sequence to the important map first published in 1625 in the third volume of Purchas' 'Pilgrimes,' reissued in 1631 in Pelham's 'God's Power and Providence,' and finally in the fourth volume of Churchill's 'Collection of Voyages' (1704–1732). This is generally and conveniently known as Edge's map, because it contains the result of his explorations, but it would be better to call it the Muscovy Company's map, for it is drawn from materials in the company's possession, and includes all the discoveries made by their servants up to the date of its appearance. It is far better than any previous map, and than most that followed it for half a century. It

* Manuscript chart in British Museum, S.T.A. (2) f.

shows the west coasts of Barentsz. and Edge islands, the south point of North-east Land, and, by marking Wiches Land, has given rise to much controversy. This is the last seventeenth-century British contribution to Spitsbergen topography. The Muscovy Company's servants continued their explorations from year to year for many years, but none of their observations have ever been published, nor have they survived. This Muscovy Company's map produced considerable influence upon foreign cartographers. A rude Italian copy of it appeared in 1630 in Sir Robert Dudley's 'Dell' Arcano del Mare' (Florence). This Spitsbergen type was next introduced into the polar chart in Hexham's

BLAEU'S MAP OF SPITSBERGEN, MAINLY AFTER EDGE. 1662.

English edition of the Atlas of Mercator and Hondius of 1636, but till 1652 I cannot find that it was adopted in Holland. In Blaeu's Seespiegel, published in that year, though Hondius' polar chart is copied, the special map of Spitsbergen still adheres to Daniel's type.

It was the enterprising Hendrick Donker who first gave currency to a more developed Spitsbergen in his atlas in 1655, and it is possible that Purchas was not his authority. He also added a valuable local chart of Smeerenburg bay, afterwards copied by Van Loon (*c.* 1660) and by G. van Keulen (*c.* 1705–10). Jan Janssonius, the successor of Mercator and the Hondius, and the rival of the Blaeus, copied Blaeu's copy of Hexham's polar chart in 1657. Donker's type was adopted by

all the progressive Dutch publishers, such as Van Loon (*c.* 1660), Colom (*c.* 1660), and P. Goos (1662). The Blaeus, in 1662, went direct to Purchas' book and reproduced his Spitsbergen map with modifications on the north coast, and notably with the addition of Hinloopen strait. G. Valk and P. Schenk, about the same time, likewise issued a large chart in which many of the Blaeus' erroneous additions were removed and their place taken by a mere straight coast. Better still was Arnold Colom's Spitsbergen in his undated Nieuwe Pascaart, which we may ascribe to about 1662, where the bays in the north coast are for the first time approximately correct in number and relative position.

Thus far only the west coasts of Barentsz. and Edge islands had ever been delineated, and only the mouth of Wijde bay. In 1663, however, a new departure was made by Hendrik Doncker when he issued in his atlas (Brit. Mus. S. 4 (18)) the 'Paskaert van Spitsbergen met Alle zijn Zeekusten zoo veel tot noch toe Bekent is.' Here we are shown the whole depth of Wijde bay, all the west shore of Hindeloopen strait, and the east coasts of Barentsz. and Edge islands. We also find the Seven islands roughly marked, and part of North-east Land indicated. The Rijk Yse islands are also set down for the first time, though they are said to have been discovered twenty years before. This new type was presently copied by Pieter Goos in 'De Zee-Atlas ofte Water-weereld' of 1666. It reappeared in the Spanish edition of 1669 and in the English editions of 1669 and 1670. Spitsbergen is similarly depicted in a chart published after 1670 at Amsterdam by Jacobus Robijn (copy in my atlas at the Roy. Geog. Soc., London). We meet with it finally, produced on a larger scale by J. van Keulen in his atlas of 1687, and by G. van Keulen down to the time when he substituted the Giles and Reps chart for it about 1710.

When first observed it may seem surprising, but on reflection it will be found natural, that from the date of the publication of the Muscovy Company's map by Purchas in 1625 down to the issue of Scoresby's map in 1820, no original or improved chart was issued from England or as the result of English surveys. English whaling was first carried on by the Muscovy Company, who had reasons, or thought they had, for keeping their discoveries and surveys secret. It seems probable that their records were destroyed in the Fire of London—at any rate, they are not known to have been seen for more than two centuries. After their day was done, English whaling utterly declined. On the other hand, throughout the seventeenth and eighteenth centuries, whaling was one of the most energetically pursued Dutch industries. Thus all the new charts were Dutch, and such English Spitsbergen charts as were issued from time to time were belated copies of Dutch publications.

In the text accompanying the English atlas, published at Oxford by Moses Pitt (1680-83), it is written, "Had our men . . . been careful

to make Charts as our industrious Neighbours (the Dutch) oblige their shipmasters to do, divers discoveries had been asserted to this Nation, which are now almost disputed from us. The Dutch gave names . . . to places long before discovered by the English, as if themselves had been the finders." The polar chart that follows is practically a copy of that in Hexham's Mercator, and it seems as though the Oxford editor only knew of the Muscovy Company's survey through that Dutch medium, so completely was geographical research and compilation at that day dominated by the energetic Dutch publishers of maps.

In the year 1707, Giles, the Dutch whaling skipper, made his famous circumnavigation of the whole Spitsbergen group, and discovered the east coast of North-east Land with the islands off it, and especially Giles Land. Another skipper, Outger Reps by name, went over part, at all events, of the same ground, for his name is given to an island off the eastern part of the north coast of North-east Land. These two men, Giles and Rep, were evidently whalers of experience, and seem to have been regarded in their day as the best authorities on Spitsbergen geography. Accordingly, Gerard van Keulen, the enterprising map publisher of Amsterdam, employed them to produce for him an entirely new Spitsbergen chart on a much larger scale than any before published. The result was the 'Nieuwe Afteekening van Het Eyland Spits-bergen opgegeven door de Commandeurs Giles en Outger Rep en in't Ligt gebragt en uyt gegevon door Gerard van Keulen,' unfortunately without a date. This chart represents the high-water mark of the prescientific surveys of Spitsbergen. Almost every important feature of the coast is set down somehow, though with great inaccuracies in latitudes and longitudes. Some features are depicted which the modern charts wrongly ignore, as, for instance, the little bay of the Basques between Magdalena and Hamburger bays.* In point of nomenclature, Giles and Reps' chart is less valuable. Many of the old names had been forgotten, others transposed. Some sites were wrongly identified; as, for instance, that of the English settlement in Bell sound. But, on the whole, the chart is a very fine work for its date, and it was never superseded till the modern survey was made. Parry used it on his polar expedition in 1827, and bore witness to its rough general truthfulness. Van Keulen issued it on a smaller scale with the surrounding seas in his Oostersee Karten. Zorgdrager practically copied it with unimportant alterations in the various editions of his 'Bloeyende Opkomst der . . . Groenlandsche Visschery' of 1720 and later. It is unfortunate that Giles' own work should not be better recorded. Daines Barrington instituted inquiries about it, and put on record that Mr. C. Heidinger, publisher in the Strand, London, intended,

* This is marked on the map of the Yszee in Colom's atlas of 1656, and in many other charts mentioned above.

in 1775, to use Gillis's surveys (of which he had copies) "for a new and accurate map of Spitsbergen, for which he has collected many valuable materials, which he proposes to add to a new edition of his translation of Prof. Le Roy's 'Narrative of Four Russian Sailors.'" Heidinger published that narrative in 1774, but the proposed second edition and new map seem never to have been issued, and all the materials collected are lost.

R. van Wyck also freely copied the Giles and Reps' chart towards the end of the eighteenth century, making a further confusion in the names. His original manuscript drawing is preserved in the library of the New York Geographical Society, and there is an accurate tracing of it in my atlas at the Royal Geographical Society in London. A small engraved copy of it illustrates B. de Reste's 'Histoire des Pêches' (Paris, 1801, vol. iii. p. 79), and a large engraved copy is included in the portfolio accompanying R. G. Bennet and J. Van Wijk's 'Verhandlung over de Nederlandsche Ontdekkingen,' etc. (Utrecht, 1827). Zorgdrager's version of the Giles and Reps' chart finally served as foundation for the map introduced by Scoresby to illustrate his 'Arctic Regions' (London, 1820), the chief difference between the two being that Scoresby, by compressing the longitudes approximately to their just extent, made the general contour of the west island fairly correct.

In conclusion, I may perhaps be pardoned for stating that the above short and dry summary contains the pith of nearly seven years' study of the subject. During that time I have ransacked most of the collections of charts in Europe likely to contain early maps of Spitsbergen, and I have traced every one that was not merely a direct copy of some other already known to me. I have been fortunate in obtaining permission to photograph some of the rarest. Finally, I recently had the good luck to acquire by purchase seven or eight examples of some of the most important charts mentioned above. The collection of tracings, photographs, and originals thus formed has been bound in a volume, which I have deposited in the library of the Royal Geographical Society. The subject is not, of course, either of much general interest or of great historical importance, but it is possible that the existence and accessibility of my 'Historical Atlas of Spitsbergen' may suggest to some other student an interesting line of investigation which can be applied to any other district or country in the world. Nothing shows more plainly the slow growth and temporary decay of knowledge of a district than the juxtaposition of the various maps of it, issued at successive dates.

BASUTOLAND AND THE BASUTO.*

By Captain R. CRAWSHAY.

WHAT is so commonly said of the people of Great Britain, that they do not know their own country, is more applicable to South Africa in general, and to Basutoland in particular, from without as well as within. If you question any ordinary ten people of the whites of our South African colonies as to what they take Basutoland to be, nine out of the ten will reply, "Why, part of Cape Colony." Question them further as to whether it is under the government of Cape Colony or not, and probably they will reply scornfully, "How otherwise?" It is no exaggeration to say that from without in South Africa the ignorance prevailing in regard to Basutoland is astounding, and that within—with few exceptions—the whites do not know the correct native names or heights of mountains in sight and easy reach of which they have been living for years. As always in such countries, it is the missionaries who know most.

During ten months, in 1901–1902, I happened to be employed by Remounts in purchasing horses in South Basutoland. In this capacity, making Maseru my headquarters, I travelled over 2000 miles on horseback, by road and bridle-path, so had good opportunities of seeing something of the country and people from an outside point of view. By request, I now endeavour to record my impressions, which, given freely and frankly, "without partiality, favour, or affection," will, I hope, be taken in the spirit in which they are offered.

The Basutoland Protectorate—or Lesuto, as its people know it—has well been styled the Switzerland of South Africa. This is not as applicable to the western as to the eastern portion; nor is it at once remarkable on the 90-miles journey from Bloemfontein, the capital of the Orange River Colony, to the western border, because the change in the intervening country is gradual—from at first almost a dead open flat, relieved only by occasional low stony hills, to mountain and flat about equally proportioned. It is with Southern Basutoland that I have acquaintance, by which I mean from Maseru, the capital, to Kuthing, south of the Orange river, a distance of some 130 miles. This constitutes a country unique, probably, to all South Africa—densely populated, much cultivated, full of live stock; so much so, indeed, that there is not a foot of spare land. The monotony of the bare highland prairies of South Africa is not apparent in Basutoland, for here the face of nature changes at every turn. In all directions are mountains of striking contour—this one with a sugar-loaf peak—Machachi, that one with a flat saddle-back, from which rise potato-like excrescences—

* Strictly speaking, "Basotho," as a noun of Class 1. I observe the rule of the Society in retaining existing spelling, to avoid confusion.—R. C.

Thaba Ntelle, another with a beak-like rostrum protruding at right angles into space—Kheme, the majority crowned with frowning precipices, but all with their upper slopes studded with boulders, and in most cases their summits of solid rock. There is a personality about each which makes one inquire its name.

Maseru is scattered over the slopes of several small hills within the bend of the Caledon river, here forming the western boundary of the Protectorate. Here reside the Resident Commissioner with his principal officials. The remaining white population consist of the clergyman, manager of the Standard Bank, the proprietors and employés of four trading stores, a saddler, and the usual complement of carpenter-blacksmiths, who combine their third calling of lodging-house keepers as well. The native population is considerable and undesirable, owing to their disregard for sanitation.

For the purpose of administration, the country is divided into districts under assistant commissioners. The towns where these officials reside constitute, as it were, European reserves, where the white officials hold sway, whereas outside the chiefs are responsible for what goes on, subject to direction from the officials. The control exercised over the natives is of a dual nature—on the one hand European, on the other that of the chiefs, who retain practically supreme power over their people. It is not an infrequent occurrence for a man to be "eaten up" —that is, have all his property confiscated—by his chief, for perhaps a trivial offence. Power such as this is open to abuse; but were it taken from the chiefs, their medium would be unavailing to control their people. It may be fairly claimed for Basutoland that, if not strongly governed, it is yet governed—as it is believed—in the first interests of natives, by a resident commissioner, who, whatever may be the views held by the whites of South Africa as a whole, will not, if he knows it, see his people suffer injustice.

No one visiting the country for the first time, more especially if he be one who has seen much of other parts of South Africa, can fail to note what an object lesson it affords of the development of practical enterprise on the part of the African native.

Following the road south to the southernmost border, you pass through almost one continuous stretch of maize, wheat, oats, or sorghum, according to the time of year. No sooner is one crop out of the ground than another is put in. No manure is used, so cultivation goes on until the land exhausts itself, when there is nothing for it but to let it lie fallow to recover. It is surprising that, having attained so far, the Basuto have not attained further, in returning to the land the refuse of the crops in the shape of straw, instead of burning this on the clearings where the grain is threshed by the primitive method of beating it with sticks.

All cultivation—with rare exceptions—is done by the plough, drawn

either by oxen or ponies. Hoes are used for cleaning the crops, sickles for reaping. The men do the ploughing, harrowing, and sowing; men and women the hoeing and harvesting. Nothing could be more picturesque than the ordinary prospect in Basutoland, the rich green crops on the lowlands, the live stock grazing over the slopes, and the villages perched up amongst the crags, commanding a view of all below. In the spring or summer, when the air is clear, the contrast of colours in the green herbage, the brown houses, and the reddish-brown rocks resembles a peep into fairyland. At the same time, distance lends enchantment to the view, for the average Basuto are as filthy in their habitations and food as the wildest tribes of the interior—more so, indeed, in food than almost any people I have come across. An ordinary village consists of from less than half a dozen huts to, in the case of a chief, forty or fifty. The huts are of stone, thatched with grass. Many are rectangular, of good size, especially those of the chiefs, and in a few cases roofed with corrugated iron. The majority are circular, some 10 feet in diameter, with a fairly decent door, and perhaps one or more windows, ranging from mere holes blocked by a single stone or rag, to others 2 or 3 feet high by 2 feet broad. A reed fence forms a sort of courtyard to each hut, or perhaps several huts, the doorway hung with an old sack as often as not, and leading out on to the refuse mound, the accumulation perhaps of years. The precincts are impossibly filthy—bones, hoofs, horns, and other refuse lie about everywhere. In every village there are one or more "kraals" built of stone, in which at nights the live stock are kept.

In live stock and poultry the Basuto are distinctly well off; they have horses, asses, cattle, pigs, sheep, goats of several breeds, including the Angora, turkeys, geese, ducks, fowls, pigeons, and occasionally guinea-fowl. A few of the chiefs have ostriches—a standing grievance to the people on whose crops they batten. On, or rather partially *in*, the ground are built little shelters of stone for the poultry, each large enough to accommodate a sitting bird. As all wild carnivora, and indeed all mammals larger than a mole, have been exterminated in the inhabited districts, the defenceless occupants are not molested. Dogs are the plague of the country—curs of every description, some showing a grotesque likeness to such noble ancestors as mastiffs, St. Bernard's, setters, and pointers; the majority of the ginger-coloured, prick-eared, sharp-nosed, curly-tailed type usually in favour with the African.

At one time, probably, the country was wooded with dwarf forest; now it is absolutely bare, except for scrub and heather high up in the mountains. The only fuel in use is the dung of cattle, the collecting and drying of which is a chief industry of the Basuto women all the year round. In the inhabited districts, there is no undergrowth larger than the wild raspberry and blackberry, both of which are widely distributed. There is no bracken—at least, I have seen none. A

conspicuous flower in the low country is a dark-red wild zinya, in colonies here and there. Trefoils grow luxuriantly in most places, the commonest being one with a brilliant dark crimson flower, and leaves no larger than the shamrock. The British buttercup and red poppy are everywhere.

Nowhere in the world is there a country more destitute of game, furred or feathered. Follow the roads or bridle-paths, ride wide of these anywhere in the inhabited regions, and in 50 miles you will not see as much as a dropping of a hare or francolin. Everything in this way has been exterminated. Quail (*C. capensis*), being migratory, are to be had in their season in fair numbers, though mercilessly persecuted by men, boys, and dogs. A lovely blue rock pigeon (*Phœnota vinacea*) is fairly abundant, by reason of its haunts in the precipices being inaccessible. High up in the mountains *Pelea capreolus* (a small grey antelope) are fairly plentiful, though difficult of approach by reason of their goat-like haunts and habits, and their extraordinary powers of vision and hearing. Baboons inhabit such mountains as Machachi, though what they subsist on is a mystery. A fair bag of francolins and hares can be had on the higher mountains intervening between the native locations. In the low countries, on newly ploughed land, I have several times seen small flocks of ibis. A common and very confiding bird of prey seen everywhere, very often on the telegraph wires, is a small, beautifully coloured terracotta-red and French-grey kestrel. The hooded raven is as ubiquitous as in most African countries. Another species, all black and of lighter build, is especially amusing to watch, with his merry gurgling crow and dancing antics. During my stay in Maseru, I twice remarked a pair of large owls (*Bubo verreauxi*) in the eucalyptus and wattle plantation known as "Hades." Widow finches are very numerous, and destructive to crops. Larks and creeping warblers are the commonest birds in the open country. Bulbuls and sparrows are plentiful in the townships, where they levy heavy toll on the fruit. Rollers, hoopoes, and nightjars are very rarely seen. A few duck are to be seen now and again on out-of-the-way pools. It is not a snipe country. On the little-known slopes of the Drakensberg, on the eastern border, there are rumoured to be such mighty antelopes as the eland and hartebeeste, also leopards and other carnivora. Snakes are very rarely met with, if I am to judge from my own experience. I collected one harmless species at 10,000 feet on Machachi, which Mr. Boulenger determines as *Amplorhinus multimaculatus*, one of the Psammophidæ, or sand-snakes; perhaps I saw the sloughs of about two more found in the lowlands. Two species of diptera—an Æstrid and a pupiparous species—are parasitic on horses chiefly. *Gastrophilus equi* reproduces its species in the ordinary way, by depositing its ova on the hairs of the forehand, whence they are bitten off by the host, swallowed, and matured as larvæ in the stomach. *Hippobosca rufipes* has a more remarkable life-history, as given me by Mr. E. E. Austen, of the Natural

History Museum: "The female produces a single living larva at a time, the lava attaining full growth within the body of the mother by means of a sort of placental connection with the wall of the oviduct. On being extruded, the larva at once pupates, in consequence of which the group of flies to which *Hippobosca* belongs has been termed Pupipara." There is much to be done for entomology in the highlands, and even in the lowlands, in the less-known orders. In fact, I think up to the time of my visit nothing in this way had been collected, except Rhopalocera by Mr. Trimen long ago. Quite a number of my Heterocera proved new; also one Rhopaloceron, taken high up in the mountains, a good many Hymenoptera, and one large Arachnid, described by Mr. R. I. Pocock. The only land-shell so far recorded from Basutoland is one from Machachi, described by Mr. Edgar Smith as *Achatina Machachensis*, n. sp.

The Basuto deserve every credit for their energy and industry in agricultural development, even though the motive be *money* wherewith to purchase live stock and wives. But when this has been said for them, with the exception of such enlightened chiefs as Jonathan Molapo and those of the younger generation who have been highly educated by the missionaries, they are far below the natives of the interior in that healthy morale which characterizes wild men.

All who have travelled in the interior of Africa will have experienced the extraordinary hospitality of its peoples, though it may be not all at once, perhaps, because either the strangers are objects of terror or suspicion, or because they will precipitate hostilities by helping themselves to what they find without first exchanging—what very often are the most absurd—preliminary courtesies, or for some other reason. Invariably, when once friendly relations have been established, hospitality is met with everywhere; whatever the people have in the shape of food they bring—fowls, eggs, vegetables, grain; in the case of chiefs, a goat, a sheep, or a bullock. If such hospitality is withheld, it is considered hostility—in fact, a declaration of war, if not explained. During my time in Basutoland, it often happened that I slept out where night overtook me, sometimes without a bite of food or drink, but never once did a native offer me anything, nor would they sell me as much as an egg at any price. On the other hand, from their chiefs downwards, they were not ashamed to beg. Nsani of Maseru came to me to beg meat from the carcase of a Government horse on which I was holding a post-mortem.

A fair test of the African's status as a man is the standard of virtue prevailing amongst his female kind. It used to be said of the Amazulu, "A waggon-load of trade goods will not buy the dishonour of a woman!" The same applied to the Nyasa tribes in days gone by. Doubtless it still holds good, except in the case of abandoned women in the neighbourhood of European settlements. It cannot be said of

the Basuto women, whose immorality is without restraint. What a contrast to the women of the interior, whose modesty is such that, even when in a European's employ for quite a time, they will rarely address a word to him on any matter however urgent, nor can they readily be brought to reply to a question addressed to them in connection with their work or pay! The result of this polyandrous propensity on the part of the Basuto women is that disease is exceedingly prevalent.

The Basuto possess almost none of that interest which attaches to wild men. Their natural habits, the outcome of instinct, have been lost from contact with whites, whose vices they have absorbed, without their virtues. The first impression one has of them is that they are a mongrel race, not Bantu, but a cross between these and some xanthous people of South Africa, with perhaps some European blood as well. All colours are they—bronze, yellow, and yellowish-white. A common feature noticeable amongst them is a long hooked nose, of Semitic shape above, having the squat tip and wide-open orifices of the negro. Some have hatchet faces, beetle brows, lantern jaws, thin lips, or almost almond-shaped eyes. Bishop Steere's definition of a "nigger" as opposed to a "native" used to be "a native in European clothing." Dress up a negro with a view to making him as grotesque a figure as possible, and you have a very fair idea of the ordinary Mosuto. A tawdry multi-coloured woollen night-cap with a bobbin-like tassel is worn, pulled down over the head, covering the brow, the ears—as often as not—and the nape of the neck. The only upper garment of any sort is a coloured woollen blanket or shawl with fringes, worn humped over the shoulders, where it is pinned by a safety-pin about 6 inches long, specially imported for the purpose. Below this are trousers, tattered and plastered with patches of cloth of all kinds, retained in position by a money-belt, or it may be braces. Clumsy boots, with or without putties, or bandages of rags, complete the illusion. Figures such as these throng the towns and elbow and jostle one another in the stores, or are to be met on the roads and paths, perched on the backs of unkempt ponies. No Mosuto will walk a yard if he can help it; failing a pony or donkey, they will ride an ox or a cow, small boys at play even a goat.

The dress of the women resembles rather that of the Dutch. On their heads they wear coloured handkerchiefs tied under the chin, bright colours, such as orange, yellow, and green, being in especial demand. The only other garment is a plain print dress, with a shawl over the shoulders. Women living in the towns as a rule wear stockings and shoes.

The above description applies only to the Basuto as a whole. In the case of some chiefs and of the educated members of the tribe, their dress is identical with that of the European in the *minutest detail*, even to high linen collars.

European settlements are a pleasing contrast to other parts of the country, for they are green oases in an otherwise treeless waste. Many European timber trees and all fruit trees thrive well with little care. The oak grows as luxuriantly and twice as fast as in Great Britain, bearing acorns more than double the normal size. Its timber is not as hard, owing to its quicker growth. Scotch firs—indeed, all firs—do particularly well; also the walnut, Spanish chestnut, beech, mountain ash, and black poplar. The willow does well in moist land. I was disappointed not to see either the elm or the lime. In the residency garden at Maseru there are many familiar shrubs from home, including lilac, laurel, box, and syringa. Common creepers on the houses of Europeans are jasmine (white and yellow), honeysuckle, clematis, and passion flower. Privet as a fence grows with great vigour, a mass of strong-smelling flower in the summer. The quince also is largely utilized for fences, so that, with its handsome and highly edible bright yellow fruit, it is as profitable as conspicuously pretty. Fences of cherry are occasionally seen; one in particular do I remember in the Government secretary's garden, which provided more than one cherry tart for the police mess. Owing to the complete rest afforded by the hard winter, stone fruits grow anyhow, bearing crops so heavy as to cause their branches to split under the weight. There are apricots, peaches, nectarines, a few plums, greengages, pears, apples, mulberries, figs, and grapes, not always, it may be, producing fruit of the best *quality*, but in astounding *quantity*. Never anywhere have I seen heavier crops of apricots than on some of the trees in the police mess garden at Maseru. Bush fruits I saw none, except two stunted gooseberry bushes in the garden at Motsekuwa. The strawberry is widely distributed. The winters are too severe for such tropical fruits as the banana, the paw-paw, and the custard apple. Lemons do very well at Moriya; oranges are nowhere a success. Vegetables are somewhat disappointing—perhaps because they do not receive sufficient care. Cauliflowers, cabbages, Jerusalem artichokes, beans, and asparagus are about the best. Potatoes, as a rule, are very poor.

The *great mistake* made hitherto in timber-planting in Basutoland has been the universal introduction of the eucalyptus, with its known tendency to desiccate—in a country already too dry—and to poison all other vegetable growth in its vicinity. The Australian wattle would have been preferable.

Firs would have been best of all, for, though slow growers, they thrive capitally, and, shedding their spines, these retain the moisture in the soil after the manner of coconut-fibre.

Much has been written of the pony of the country—that he is a paragon of soundness, of bottomless endurance, worth any money. After ten months' purchasing for army requirements, my experience is, the first qualification is rarely met with in adult animals; the second

results from the spartan rearing, involving the survival of only the fittest; and, granted the two first, the third follows as a matter of course. The Mosuto—after the manner of the native—is a bad master to his beast, using him hardly, working him as if regardless of his being flesh and blood, and begrudging him any other food than such grass as he is able to pick up for himself. No compassion is shown for either extreme youth or old age.

By far the most interesting portion of the Protectorate is the mountainous eastern half, commencing about 30 miles east of Maseru, and extending to the Natal border. Unfortunately, having my duty to do, the most I was able to do was to enter the promised land—in other words, to make the ascent of Mount Machachi and put in three days on its slopes. This had been reported to me to be the highest mountain in the country, 11,000 feet; but I was afterwards assured by the Rev. R. H. Dyke, of Moriya, whose father was the pioneer Huguenot missionary in, I think, 1844, that Mount Hamilton, on the eastern border, is considerably higher—over 12,000 feet, and that Machachi is not as much as is believed by the Protectorate officials.

Leaving my spare horses and mules at a point about 7 miles from the foot of the mountain, and using two ponies for our packs, myself and servant, with two natives, walked to the base, and the next morning climbed the mountain by a fairly good, though steep, circuitous track to a col some 800 or 1000 feet from the summit, where we put in two nights in the open. It was in the rainy season, but, with the exception of the first night, the weather was fine, though cold and boisterous.

From the bare ill-watered lowlands to the slopes of Machachi, with its abundant clear cold streams, its invigorating atmosphere, its profusion of wild flowers, and new forms of insect and animal life at every turn, was indeed a delightful change. About half its time the rocky peak is hidden in the clouds. During the cold season the snow lies for weeks and months on the upper slopes.

Pelea capreolus are tolerably plentiful at the higher altitudes, and I was glad to have this opportunity of observing them. Like goats, they look for danger from below, not from above. From the nature of the country they frequent they are difficult to approach, for the slopes are open, steep, and covered with loose stone, and, sound travelling readily, the least noise made by displacing a stone tells its tale. Then from the slope above or across a valley comes the weird cry of alarm—"Haa!"—from a buck standing motionless amongst rocks the colour of his coat. I have tried to locate the whereabouts of a buck for several minutes, during which he has periodically uttered his alarm, but have not been able to distinguish him until, in turning to go, his white tail betrays his form. High up on the mountain I remarked a field rat with large ears, of which I could not secure a specimen, having neither a gun nor a trap.

Wild flowers are in *extraordinary* profusion—heaths, ixia, gladioli, hyacinths, primulæ, carnations of *tiny* size, meadow orchids, g:rania, and ferns.

The summit of Machachi is of solid rock, in process of disintegration in the alternating heat and frost. Dr. Flett, of the Geological Survey Museum, has determined a specimen of this to be amygdaloidal lava, containing apophyllite and prehnite, coated with dark green chlorite. Another rock from 1000 feet lower altitude is pronounced by the same authority to be ophitic olivine dolerite reddened by decomposition.

All over the mountain there are abundant streams of the clearest water possible, often flowing over beds or through basins of solid rock. Water oozes from under the rocks within 150 feet of the summit.

Parts of the mountain are sheer precipice, especially to the north-west and north-east. From the summit, looking eastward, the view is one of magnificent and weird grandeur, a knotted mass of mountains, little inferior to Machachi, the contour of which no man's eye could define. In the opposite direction, the vast expanse of what in comparison is flat country lacks salient features on this account, and, at the time I viewed it, was much obscured by the lowland haze.

Much has been written in reports of the richness of Basutoland as a grain country, producing for its size more maize and wheat than any other part of South Africa. If this is to be maintained in the future, some effective scheme must be evolved to preserve the rainfall for the land, and prevent the wholesale wash off and wash out of the Earth's surface ever increasingly going on. In the neighbourhood of towns, on the roads and tracks, and on slopes denuded of vegetation, watercourses are formed—at first the merest crevasses, ultimately becoming huge ravines 30 or 40 feet wide and 20 deep, which receive the rainfall of a large area of land, bearing this away with little or no benefit to the land drained, at the same time washing off its top soil in doing so, besides carrying away huge masses of earth from the banks of the ravines themselves. What is wanted is to arrest the growth of such watercourses where formed, and to prevent their formation by enabling the land to absorb its rain, which may be done by not denuding it of its grass—better still, by planting timber. It is, of course, hopeless to look to native enterprise to do anything in this way. Therefore it can only be done by Government, with funds raised by taxation.

Bridges are badly wanted across the Great Caledon river (where, when the river is very high, the pont cannot work), the Little Caledon river, and the Makhaleng river on the north of Mohaleshoek, which, in the rainy season, delay traffic for days on end, causing loss of property and sometimes loss of life as well.

It is late somewhat to legislate for contagious diseases, but much good might yet result from this, in the case of man and beast. No country in all Africa could be better off in facilities offered to the

natives to educate themselves. There are mission stations at every few miles—those of the Church of England with its headquarters at Masite, the Roman Church, and, most numerous of all, the French Protestant Mission with its headquarters at Moriya. All are deserving of the greatest credit for the pitch of education to which so many of the young Basuto have attained.

No man could desire a healthier or pleasanter climate than that of Basutoland. It nearly resembles what that master man and mind, Sir Richard Burton, has termed the "champagne air of the desert." Never does one experience any sensation of lassitude. It is hot in the hot season, though not oppressively so. During the summer I was there, the maximum temperature in the low country, *i.e.* 5000 to 5500 feet, did not, I think, exceed 94°. The cold is proportionately much greater, 15° to 20° of frost not being uncommon, accompanied by hail, snow, and cutting winds, fatal alike to man and beast. In June, 1902, there was just such a spell of cruel weather—hail, snow, rain, wind, and frost, in conjunction or rapid succession, productive of wholesale disaster. There were reported to have died from exposure to it, between Aliwal north and the south-west border of Basutoland, some twenty-eight natives. There was hardly an owner of live stock in the country who did not suffer heavily. For quite a fortnight the snow lay at Mafeteng, altitude about 5100 feet. As is only to be expected from the conformity of the country, there are terrific thunderstorms in the hot season. If the traveller comes in for one in the Moriya-Masite-Kheme valley, he cannot fail to be impressed by the awful grandeur of the elements—the inky black masses of clouds rushing together from over the mountain-tops, the lurid lightning thrilling him to his marrow, the deafening thunder exploding and, as it were, splitting the rocks on the slopes above, the rain and wind which he and his horse cannot face. For the time being, he realizes what it is to feel *at the mercy of the Creator*. Luckily, such storms are of short duration; thirty minutes and the worst is over. The difficulty then is the impassability of the streams and watercourses, to say nothing of the slippery state of the paths.

The Sesuto Language.

On first hearing Sesuto spoken, it appears not to be a Bantu tongue. On closer acquaintance, there can be no doubt it is, though of another class to that of the tribes of equatorial Africa. It abounds in the letters *h* and *o*. Many words end in *-ng*.

Seven classes of nouns only are admitted in what is at present the standard grammar, compiled by Mabille and Jacottet. Myself, I should be inclined to revise these by altering the prefix of one, and by adding three more classes:—

Class I.—Prefix: sing. "mo-," pl. "ba-": motho, batho, = person.
Class II.—Prefix: sing. "mo-," pl. "me-": motsi, metsi, = village.
Class III.—Prefix: sing. "le-," pl. "ma-": leiba, maiba, = blue rock pigeon.

Class IV.—Prefix: sing. "se-," pl. "li-": seolo, liolo, = ant-hill.
Class V.—Prefix: sing. "bo-," pl. "ma-": bosiu, masiu, = night.
Class VI.—Having no prefix in the singular: ntsintsi, dintsintsi, = fly.
Class VII.—Having irregular plural: leihlo, mahlo, = eye; leino, meno, = tooth.
Class VIII.—Having no prefix: metsi, = water.
Class IX.—Infinitives of verbs: "ho": ho palama, = to ride, riding.
Class X.—Locative: "ha."
I am indebted to Sir Harry Johnston for the insertion of Class X.

A few common verbs are—

Ho ya = to eat.	Ho hela = to cut grass.
„ nwa = „ drink.	„ thiba = „ stop.
„ tlisa = „ bring.	„ bitsa = „ call.
„ tlosa = „ take away.	„ lema = „ cultivate.

At a person's is expressed by "ha." "Ha Bereng" = "At Bereng's." At, on, or in a place, by a suffix ending in *-ng:* "Thabaneng" = "On the hill." The usual greeting is "Dumela!" or if addressed to a chief or European, "Dumela Morena!" "I trust you, chief!" to which the reply is a long-drawn "E—E—E!" This, as a rule, is followed by the question, "U ea kae?" = "Where are you going?"

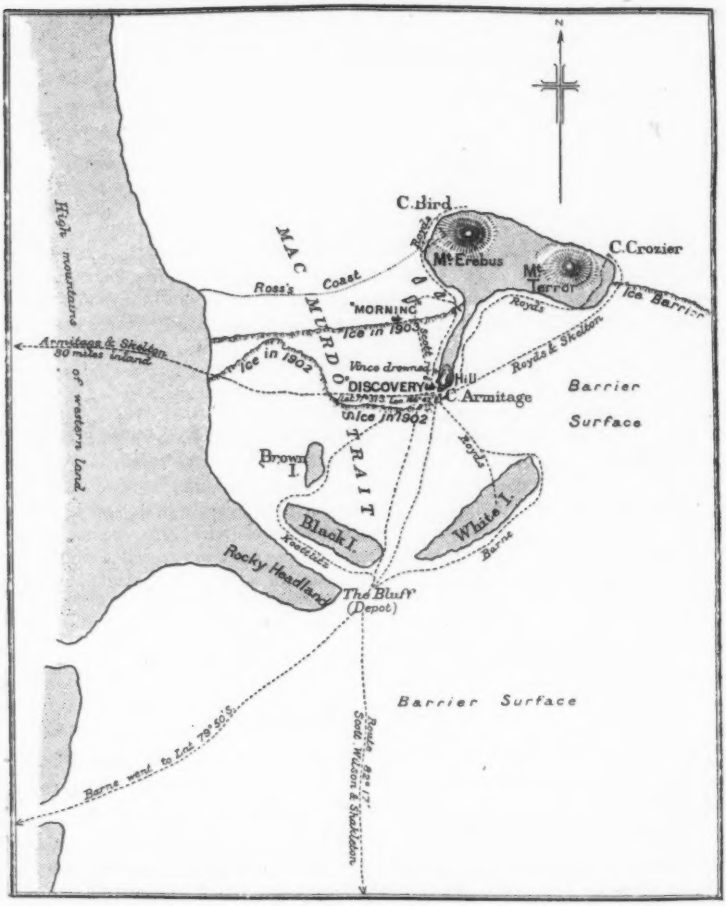
As a people, the Basuto are impertinently inquisitive, questioning one or one's followers on meeting, continuing this until they have passed out of earshot, or even accompanying one some distance to do so. Many hundreds of times have I been obliged to rid myself of noisy inquirers by telling them to go their way and leave me to go mine. A common practice is to ask for matches—even to stop one expressly for the purpose, by shouting from a distance.

From this, and from their general behaviour to Europeans in a hundred other ways, it is obvious they have not that respect for them which, from contact with the tribes of the interior, and even the Zulus, one has come to expect. Familiarity with the lowest class of white, some of whom are to be found in Basutoland, has bred contempt.

THE ANTARCTIC EXPEDITION.

The mails which reached this country during the month of May have brought numerous private letters from members of the British Antarctic Expedition as well as the official report of Captain Scott. The latter will form the basis of the communication to be made by the President at the meeting of June 10, on the results of the first season's work in the Antarctic; but various details, supplementing those previously published, are to be gathered from the letters above alluded to, extracts from which have been published in the public press. The fuller information thus available confirms in the most satisfactory manner the favourable impression conveyed by the original telegram as to the results attained, both at the base station and during the various sledge expeditions. Among the most important geographical results,

in addition to those previously mentioned, are, in the first place, the discovery that Mounts Erebus and Terror form part of a comparatively small island, the so-called McMurdo bay being in reality a strait; and in the second the establishment of the fact that a great continental mass of inland ice extends westward a considerable distance from the coast,



ROUGH SKETCH BY LIEUT. C. W. R. ROYDS, SHOWING THE POSITION OF EREBUS AND TERROR ISLAND AND THE WINTER QUARTERS OF THE "DISCOVERY."

at an altitude of 9000 feet. It was during the sledge expedition of Lieut. Armitage and Lieut. Skelton that this ice-sheet was ascended, the accomplishment of the feat entailing the greatest difficulties. The party had no dogs, and were obliged to drag their own sledges, which

had to be continually unloaded, lowered down into crevasses 50 to 60 feet deep, and hauled up on the other side. Arrived at the summit, one man suffered severely from the rarefied air. The extensive character of the land discovered during Captain Scott's southward sledge journey seems fully borne out by the further details received, and the mountain ranges which traverse it are said to reach a height of 14,000 feet. It appears that the land discovered at the eastern end of the ice-barrier is distinct from the southward extension of Victoria Land, and Captain Scott proposes to name it King Edward VII. Land.

As regards the voyage of the *Morning*, and the meeting with the *Discovery*, it is stated that the antarctic circle was crossed on Christmas Day, three weeks after leaving Lyttelton, two islands being discovered the same day. On January 3 Victoria Land was sighted, but it was not until the 8th that a landing was effected at Cape Adare. Proceeding through heavily packed ice, a party landed at Possession island, which was covered with penguins. A wide track had been made by the birds to the centre of the island, the larger stones being removed from the paths. In the neighbourhood of Wood bay and Coulman island the ice was especially heavy. On January 14, a landing-party left a record at Franklin island, and four days later letters from Captain Scott, which had been deposited at Cape Crozier, were taken off. The *Morning* continued to force her way through the pack, and on January 23 sighted the *Discovery*, which was separated from the relief ship by 10 miles of fast ice, so that the two expeditions effected a junction by means of sledges. Subsequently some of the ice broke away, and by February 26 the distance between the two ships was reduced to 5 miles; but not even the heaviest gales did anything to further break up the intervening ice-fields. Captain Scott considers that the season was exceptionally bad, for last year, after the one year's ice originally found at the spot had broken away, the water remained open for at least six weeks. At the time of writing, shortly before the departure of the *Morning*, the weather was getting much colder and more blustering. The leader regretted the enforced detention principally on account of the waste of time, for all the party remained as keen as ever, and had it been possible to return to New Zealand this season, he had fully intended, if possible, to return for a third season's work. He says that it would be difficult to imagine a happier or more comfortable community, though the relief party saw evident traces, in the appearance of the explorers, of the hardships they had undergone, the men looking years older than when they set out. The position of the winter quarters was in 77° 51′ S., 166° 42′ E.

Among the incidents and personal adventures described in the correspondence, one of the most striking is the experience of a young New Zealander on the *Discovery's* staff—Hare by name. He formed one of the party sent out in March, 1902, to deposit a record at Cape

Crozier, which, as already mentioned, was overtaken by a blizzard when not more than 10 miles from the ship during the homeward journey. Hare became separated from the rest of the party, and, becoming exhausted in his fruitless search for the track, fell asleep in the snow. He remained asleep thirty-six hours, being soon buried in a snowdrift; but, strange to say, awoke on the second day little the worse for his hazardous adventure. It was during this same blizzard that the seaman Vince lost his life, the party with which he was having unwittingly approached a precipice, down which, being the foremost, he must have been precipitated, no trace being discovered of the missing man by the search-parties sent out from the ship.

The scientific observations have been carried on throughout with great thoroughness, over twelve months' continuous work being done at the winter quarters, in addition to a considerable amount of magnetic work, soundings, dredging, etc., at sea. Mr. Bernacchi thus describes the work accomplished in the field of terrestrial magnetism. "All the international term-days have been kept. The curves are unique and of a most interesting nature. The very large annual variation in the elements is perhaps the most conspicuous thing, but it is the individual curve that is so interesting. . . . We have something like 400 magnetograms. . . . The seismograph has been working the whole year, but very few shocks and tremors are recorded. Our largest are on May 25 and September 22, which seems to correspond with your record on April 18. There are some irregularities in the line, which might be due to the Guatemalan earthquake. . . . I have also a year's observations of atmospheric electricity." The lowest temperature recorded during the winter was $-60°$ Fahr., or $92°$ of frost.

REVIEWS.

EUROPE.

THE COAL-FIELDS OF SCOTLAND.

'The Coal-fields of Scotland.' By Robert W. Dron, A.M.I.C.E. London: Blackie & Son. 1902.

In a volume under this title, extending to upwards of 360 pages, and illustrated with sixteen plates giving geological maps and sections, besides woodcuts in the text, the author deals in succession with the coal-fields of all the coal-producing counties of Scotland. There is also a general chapter on the Carboniferous Formation as developed in Scotland, one on the Lothian Oil Shales, one on Undersea Coal, and one on the Duration of the Scottish Coal-fields. This last contains a variety of historical and statistical matter, the statistics being necessarily to a large extent conjectural. In an elaborate table on pp. 326–398, prepared by the author about 1899, and originally published in the *Transactions of the Institute of Mining Engineers*, vol. xviii., particulars are given as to the estimated quantity of coal originally available in every coal-working district in Scotland, a distinction

being made between what the compiler calls "proven coal" and "reserve coal." Under the head of "proven coal" are included all the known workable seams of 2 feet thick and over, while under that of "reserve coal" the author has reckoned all the seams from 1 foot to 2 feet in thickness and all the seams of the Carboniferous Limestone lying beneath the Millstone Grit. Taking as his basis data contained in the report of the last Royal Commission on coal, he has then calculated the total quantity of that coal that has already been worked, and has arrived at the conclusion that there remain in round numbers 4635 millions of tons of "proven coal at moderate depths" still available, besides 5994 millions of tons of thin and deep seams. In this latter quantity are included one thousand millions of tons under the Firth of Forth, the author taking a different view from Dr. Hull in his book on 'Our Coal Resources,' where the opinion is expressed that coal-mining under the Firth of Forth is impracticable on a large scale on account of the danger from water. Undersea workings are already carried on from Buckhaven, Wemyss, and elsewhere on the Fife shore, and preparations are being made to test the workableness of the undersea coal near Cockenzie in Haddingtonshire, a company having leased from the Crown the coal for 2 miles under the Firth of Forth at that point. Mr. Dron thinks that a fairly safe allowance for the extent of coal that may be worked underneath that inlet is 3 miles from each coast. According to returns which have been collected since 1876, the coal raised in Scotland in the last quarter of last century was produced by the different counties in the following proportions:—

Counties.	Per cent.	Counties.	Per cent.
Lanark	55·90	Clackmannan	1·40
Ayr	14·35	Dumbarton	1·40
Fife and Kinross	11·95	Haddington	1·20
Stirling	6·05	Dumfries and minor producing	
Edinburgh	3·75	counties	0·85
Linlithgow	2·80	Renfrew	0·35

The Lanarkshire production is still rapidly progressive, but Mr. Dron thinks that in twelve or fifteen years the most easily wrought seams of that county will be approaching exhaustion, and that the manufacturers of the west of Scotland will thus be compelled to fall back to a greater extent on the Ayrshire coal-field, in which, he estimates, more coal remains to be worked than in Lanarkshire. Fife and Midlothian are also likely to be much more productive in the near future. In Fife numerous deep bores are being made with a view to the development of the deeper seams. In Midlothian production has been kept back, it seems, "by the very conservative policy" of certain landowners, but this policy, we are told, has now been reversed, and steps are being taken by means of which the output of the county should soon be doubled or trebled. As to the time within which all the remaining coal in Scotland will be worked out, Mr. Dron, like other calculators before him, has made estimates on the assumption of a continually increasing production till the coal has all been removed; but he adds the unquestionably just observation "that long before these dates are reached, the continued increase of the output will have received a check, and that just as the output has gradually increased, so also will it gradually diminish." There we may leave the matter, for we have no means of estimating either when this check is likely to take place, or at what rate the diminution will proceed once it has set in.

G. G. C.

ASIA.

India.

'Cities of India.' By G. W. Forrest, C.I.E. Westminster: Constable. 1903.

In a fascinating series of sketches of the historic cities of India, Mr. Forrest has skilfully woven together the descriptive and historical material at his disposal, the former acquired at first hand during his journeys from end to end of our vast dependency, the latter derived from his unrivalled knowledge both of the official records formerly under his care, and of the writings of early travellers and historians. He is successful in recalling the old-time atmosphere of the events of which he writes, and takes his readers back with equal ease to the days of the Hindu dynasties of Ahmedabad and Jeypore, the Mogul rulers of Delhi and Agra, the early English enterprises at Surat, Bombay, and Madras, the somewhat later episodes at Cuddalore and Calcutta, and the Mutiny drama at Lucknow and Cawnpore. An instructive feature is the attention bestowed on the influence which geographical position and environment has exercised on the rise and fortunes of the cities. The arrangement is more or less topographical, corresponding as far as may be with an imaginary tour through the length and breadth of the country, and the book should thus prove a useful companion to the traveller who visits the historic sites of the Indian Empire. It is abundantly provided with illustrations of the cities, their architectural wonders, and other objects of interest.

AFRICA.

British East Africa.

'With Macdonald in Uganda.' By Major Herbert H. Austin. London: Arnold. 1903.

Major Austin's narrative of his latest exploring journeys in South Africa, noticed a few months back in the *Journal*, has been quickly followed by a second volume, recounting the earlier events connected with Colonel Macdonald's expedition, in which, as is well known, Major Austin took a prominent part. The complicated history of the Sudanese mutiny—the greatest danger, perhaps, to which British influence in Eastern Central Africa has yet been exposed—has never yet been the subject of a full and connected narrative, and the present volume is therefore to be welcomed as giving, not only an account of the occurrences in which its author took part personally, but also (though in less detail) of the part played by the other members of the expedition and Protectorate officials, during those critical months. It may thus serve to remove various misconceptions which have been current respecting these events. It has also an interest from a more strictly geographical point of view, especially with regard to the explorations carried out by Colonel Macdonald and his coadjutors in the then little-known districts between Lake Rudolf and the Nile. Major Austin pays a warm tribute to his leader, to whose fertility of resource, great knowledge of the country, and personal influence with the Waganda, the final success of the operations was, he considers, entirely due.

African Minerals.

'Les Richesses Minérales de l'Afrique.' Par L. de Launay. Paris: Ch. Béranger, 1903.

This book is to be welcomed as the first serious attempt to deal with the mineral resources of Africa in a comprehensive and systematic manner. Its appearance is very opportune at a time when the air is full of projects, well or ill founded, for the exploitation of these resources, and it is particularly valuable from

the unbiased standpoint of the author—Professor at the 'École supérieure des Mines'—who treats of the questions under consideration from the point of view of sober science, and is fully conscious of the reserve with which current statements as to African mineral wealth must be received. From a practical point of view, the book supplies a useful summary of our present knowledge respecting African minerals, each of which, from gold to coal and petroleum, is dealt with in turn, while the final chapters discuss the various regions in Africa from the point of view of the collective mineral deposits. The book has, however, a further, more theoretical, interest. The author has previously, in various writings, put forward his views as to the importance of the notion of *depth* in dealing with metalliferous deposits, and he now uses the facts observable in Africa as object lessons, illustrating the principles which he considers involved. He holds that the variation in the character of mineral veins according to the depth below the surface is of two distinct kinds, which have hitherto been too much confused. In the first place, there are differences due to the variations of temperature, pressure, etc., at different depths at the time of the original formation of the veins; and in the second, subsequent metamorphism will have operated in the neighbourhood of the surface, which will then be, in the majority of cases, totally different from the original surface which existed at the time when the veins were formed. It is generally impossible to study such variations as we proceed downwards in any one locality, but the writer points out that, as the amount of erosion has differed enormously in different areas, we can arrive at certain conclusions by comparing the character of the mineral deposits in two regions, in one of which a vastly greater amount of material has been removed from the surface than in the other. The African continent supplies an excellent field for such studies, by reason of the strong contrast displayed between the ancient mass which occupies its main bulk and the Tertiary zone of the north, while the subject has more than a theoretic interest, by reason of its obvious practical bearing. The introductory chapter contains also a useful general sketch of African geology as we now know it.

German South-West Africa.

'Deutsch-Südwest Afrika.' Von Prof. Dr. Karl Dove. Berlin: Süsserott. 1903.

This little handbook, which forms vol. v. of Süsserott's 'Kolonialbibliothek,' gives, for its size, the most lucid and systematic description of German South-West Africa that has yet appeared, the author being, both by his personal acquaintance with the country and by his careful study of the existing literature, particularly well qualified to write such a work. After a preliminary sketch of the history of the territory, Dr. Dove treats in turn of the broad physical features, the mineral resources, the climate, flora and fauna, and inhabitants, both native and European. In describing the surface features he divides the area into four natural regions, each of which has a distinct individuality. The first of these, the coast strip, though generally bare and arid, and showing but small variations of relief, differs considerably in its surface, sand being by no means universally present; it is, however, still but imperfectly known, especially in the south. The second, in the north and north-east (Ambo Land, etc.), is a remarkably uniform plateau with an average altitude of 3000 to 3300 feet, extending from the Kunene to the Okavango. This altitude is not great enough to admit of European settlement, but the district may serve for plantation purposes. The third region—Herero Land—the most important from the point of view of European enterprise, comprises three orographic subdivisions, the terrace lands of the north-west, the plains of the north-east, and the southern districts with the best-developed relief of the whole territory. The

fourth region is the more arid Nama Land in the south. From the point of view of vegetation, the coast strip is sharply contrasted with the other three regions. Dr. Dove considers that Swakopmund, in spite of the absence of shelter, is a far more valuable position than Walfish bay, owing to the much greater facilities it presents for penetration into the interior.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Volcanic Studies.

'Volcanic Studies in Many Lands.' By Tempest Anderson, M.D., B.Sc., F.G.S., etc. London: John Murray. 1903.

The special feature of this book is the number and excellence of its photographic illustrations. Dr. Tempest Anderson has been for many years a well-known student of volcanic phenomena, and in the course of his visits to the active and extinct volcanoes of Europe and North America, has formed a large collection of photographic views illustrative of this branch of geological research. Many of the most interesting of these are included in this work, by the publication of which the author has made a valuable contribution to the literature of vulcanology. A word of praise is due also to Mr. Murray for the admirable manner in which the volume is got up.

For scientific purposes, a well-taken photograph excels all other kinds of illustration in truthfulness and accuracy; and the study of land-forms lends itself especially to this method of elucidation. The stay-at-home geologist, who examines carefully the plates contained in this book, cannot fail to obtain clearer ideas of the actual appearance of active volcanoes, and of the stages of their growth and decay. The author has not entered into the consideration of the more recondite and theoretical questions involved in the study of volcanic action, but has contented himself with depicting and explaining the principal types of volcanic structures. He furnishes, in fact, a series of object lessons, beautifully clear and often very striking, of the scenery of volcanoes, with explanations of the manner in which the topographic features have been produced.

The familiar landscapes of Vesuvius, Auvergne, the north of Ireland, and the Inner Hebrides are represented by a number of carefully selected examples, but the Icelandic views, which were obtained during two visits to that island, possess more novelty and interest to the geologist and geographer. The enormous lava-fields, studded with little cones, are shown in the photographs, and several beautiful plates are given of the row of craters which stands upon the Skaptar fissure. Many of the great lava-streams are cut by fissures of another sort, due to the escape of the still liquid interior at a time when the surface of the mass had already solidified. The unsupported crust has then subsided along great rectilinear cracks, leaving cliffs many feet in height, which often show a striated face owing to the friction to which it was subjected as the broken mass sank to a lower level. The most celebrated instance of this is the Almannagjá, where the deep valley of the Oxerà had been filled with a gigantic *coulée* of lava, and after the surface had cooled the deeper part of the lava-flow escaped. The crust collapsed, unable to support its own weight, and left a vertical wall over 100 feet in height, separated by a chasm from the remainder of the consolidated surface with which it had at one time been continuous. One of these outflow tunnels is shown in Plate LXXII. from the neighbourhood of Lake Myvatn, and in this case the stream of molten rock entered the lake, and, on coming in contact with the water, gave rise to steam explosions, which covered the surface of the lava with small secondary craters and spiracles.

Some of the most successful views given in the book are from the remote crater-lake of Oregon, and there are beautiful illustrations of the geysers of the

Yellowstone Park and the basalts of the Snake river, Idaho. The volume is thoroughly up to date, as it concludes with a few photographs of scenes in St. Vincent, West Indies, taken by Dr. Tempest Anderson during last summer, and a fine picture of Montagne Pelée in full eruption on the afternoon of July 9, 1902.

J. S. F.

Gilbert's 'De Magnete.'

William Gilbert, of Colchester, Physician of London. 'On the Magnet . . . a new Physiology.' London, 1900. Notes on the 'De Magnete' of Dr. William Gilbert. London: Privately printed. 1901.

The first of these volumes is a new and careful translation of Gilbert's famous work on the magnet, published under the auspices of the Gilbert club. The translation follows, page for page, the original Latin edition of 1600, the general style of the latter being also retained as far as possible. It is printed at the Chiswick Press, and the whole "get-up" of the volume is most tasteful. The volume of explanatory notes, got together mainly through the energy and zeal of Prof. Silvanus Thompson, is a most valuable addition to the text, and bears witness to an extraordinary amount of research and an unusually extensive acquaintance with the literature both of Gilbert's time and the century preceding it. The allusions and references in the text are elucidated with great thoroughness, and though the greater part of the notes naturally have to do with questions of magnetic theory, there are various points of more strictly geographical interest on which much light is thrown. Thus the history of the so-called "loadstone-rock" in literature and cartography is fully dealt with, reference being made to the legends in Ruysch's map, the supposed northern voyage of Nicholas de Linna as mentioned by Hakluyt, and to Peter Plancius' location of the rock on his lost map described by Blundeville. References are given to the extensive literature on amber and the amber industry, and there are useful notes on various points connected with the compass and its use, the history of "wind-roses," and the various designations of the points of the compass. The term for the north-west used by Gilbert—Borrholybicus—is rarely met with, though one or two authorities for its use are cited. To these might be added a couple of still earlier instances, viz. the chart of the coast of Sweden from Waghenaer's 'Speculum Nauticum' of 1585, which is reproduced by Nordenskiöld in his 'Periplus,' and the treatise on the winds by Fabritius Paduanius (1601). The name is also given by Coronelli in his 'Epitome Cosmografica' of 1693 as the Græco-Latin term for the north-west wind.

Practical Astronomy.

'Grundzüge der Astronomisch-geographischen Ortsbestimmung auf Forschungsreisen und die Entwickelung der hierfür Massgebenden mathematish-geometrischen Begriffe.' Von Prof. Dr. Paul Güssfeldt. Mit 95 eingedruckten Abbildungen. Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn. 1902.

There are few men whose training and experience would render them better fitted to deal with the subject of practical astronomy for travellers than Prof. Paul Güssfeldt. His name has for years past been held in high esteem as that of a traveller and explorer of exceptional ability. His surveys in the Andes, West Africa, and elsewhere possess a scientific value and precision far in excess of those of the ordinary explorer, whilst his long experience as a university lecturer on mathematics has given him an insight into the methods of instruction most suitable to the requirements of the student who is likely to become a geographical surveyor. The work which he has recently published is, therefore, worthy of special attention, and will doubtless be read with interest by many.

It will at once be seen that it differs considerably in design and arrangement

from most others dealing with the same subject, which, however useful and important they may be in their place as text-books, giving formulæ and examples of computations, are often unsuited for purposes of instruction from the fact that they assume too much knowledge on the part of the student, and fail to give satisfactory explanations of the development of the formulæ employed. Prof. Güssfeldt, in his 'Grundzüge,' begins at the beginning, and from treating of the simplest relations that exist between numbers and quantities has endeavoured to follow up the mathematical investigations upon which the subject of practical astronomy is based step by step until he arrives at the conclusions sought and the rules and formulæ employed in fixing positions by astronomical observations. The book, in fact, treats the whole subject as connected and complete, and gives an outline of its development and growth from its foundations in elementary mathematics and geometry to its more complex computations and deductions. As its title indicates, it does not attempt to give anything more than an outline of the subject, and as the ground covered is decidedly large, it is not surprising to find that some matters appear to be too summarily dismissed. More than half of the book is taken up with preliminary matter, and this has rendered it necessary for the author to condense the latter and practical part, which after all is what the surveyor would find more useful. The actual fixing of positions by astronomical observations only forms one part of the duties of a properly qualified surveyor in little-known regions, and Prof. Güssfeldt would have added considerably to the value of his book if he had dealt also with triangulation, and topographic methods best suited to travellers, which, since the days of the pioneer explorer are almost over, are of ever-increasing importance.

The work is divided into twelve general sections, in each of which a definite branch of the subject is dealt with. The first is an introductory section treating of the elements of mathematics, logarithms, etc.; the second deals with geometry and plane trigonometry; the third with the foundations and facts of practical astronomy, such as the figure of the earth, axis of rotation, circles of the heavens, parallax, spherical co-ordinates, etc.; the fourth with time and time measurements; and the fifth with spherical trigonometry. After these follow sections six to twelve, which deal with the practical side of the subject, and show the application of the information imparted in the previous section to the various formulæ employed in fixing positions, adjustments of instruments, etc.

Although treating of the elements of the subject, in many respects Prof. Güssfeldt's book is far from an elementary work, yet it could not in any sense be considered to supersede the exhaustive and excellent treatises on Practical Astronomy that already exist, for there are many matters that are not dealt with at all in these pages; nevertheless, according to the author's avowed design and purpose, it deserves to occupy an important place as a good introduction to the whole subject, and as such it will doubtless be found useful by many. In future editions it would be well if some of the chapters could be amplified, and if its scope could be extended to render it better suited to the present requirements of the surveyor in imperfectly known regions.

CARTOGRAPHY.

French Military Surveyors.

'Les Ingénieurs Géographes Militaires, 1624–1831.' Étude Historique, par Le Colonel Berthaut, Chef de la Section de Cartographie. Paris, 1902. Imprimerie du Service Géographique.

This book is a sister work to that previously published by the same author, 'La Carte de France.' The earlier issue dealt with the history of map-making in

France; the present one is devoted to the study of the origin, the fortunes, the performances, and the eventual disappearance of the remarkable body of men to whom the maps of France and her colonies are due. The author has drawn the information contained in his two large volumes from the archives of the Dépot de la Guerre, from which source also are taken the numerous specimens of maps and plans with which they are illustrated. Colonel Berthaut's authority for all he relates is, therefore, unimpeachable.

The book, as pointed out by General Bassot, the director of the Geographical Department, in a preface which he contributes, is not one to be taken up and read through from end to end. It is rather a collection of important and interesting historical records, and is mainly useful as a work of reference, to the value of which the full table of contents and alphabetical index largely contribute.

The first attempts at detailed topographical surveying date from the seventeenth century. The pioneers of map-making were Gustavus Vasa in Sweden, Radziwill in Poland, Scheuchzer in Switzerland, Apian in Bavaria, Vischer in Austria, Müller in Hungary, Borgonia and Chaffrion in Italy. In France, Jean Leclerc, in 1640, presented to Louis XIII. a map of the country in nine sheets, engraved on wood.

Military topography at this early date was confined to the production of sketches not to scale, with heights shown in false perspective. The examples, however, of the style by Beaulieu and Sebastian Leclerc, which the author gives, are decidedly graphic, and, in their way, works of art.

The origin of the corps of *Ingénieurs Géographes* is the same as that of other branches of the engineers. During the first half of the seventeenth century, officers of special qualifications were taken from the infantry, and were employed on engineer work as *Ingénieurs aux fortifications, Ingénieurs des camps et des armées, Ingénieurs ordinaires du Roi, Ingénieurs géographes.* Beaulieu in 1639 was described as *Ingénieur et Géographe ordinaire du Roi,* and was probably the first to bear the title.

From the institution of the corps until the year 1809 the *Ingénieurs Géographes,* though charged with duties of the highest importance, and exposed to more than the ordinary risks of military service, had not the status of combatant officers, and were debarred from the prospects of promotion, and the rewards which fell to their less-deserving comrades. In time of war they were called upon to execute reconnaissances in front of the army of districts as little known as Central Africa is to-day; to provide sketches of the projected line of advance; and to furnish all military information of the routes. They had also to make plans of battlefields, sometimes before the opposing forces had closed, sometimes after the battle had been fought. In peace time they were engaged in surveying tracts of country, in sketching routes, and in compiling information concerning districts where operations were probable at some future date. In fact, they acted as an intelligence department, though dealing mainly with topographical matters.

The author divides his retrospect into eight periods, the first four ranging from 1624 to 1715, from 1715 to 1756, from 1756 to 1777, and from 1777 to 1791, and the last four covering the Revolution, the Consulate, the Empire, and the Restoration.

It is interesting to learn that, so early as the middle of the eighteenth century, the *Ingenieurs Géographes* did much valuable work in the French colonies and in foreign lands. They produced maps of Pondicherry, Trichinopoly, of the boundaries of Canada, Rio de Janeiro, French Guiana, Guadaloupe, Martinique, St. Lucia, St. Domingo, Surinam, and other places. A century and a half later Great Britain has not decided that such a work with regard to her own transmarine possessions is worth the expense involved.

Napoleon attached the greatest importance to the work of the *Ingénieurs Géographes*, though his references to that body, quoted by the author, are couched in terms neither complimentary nor appreciative. The Great Master of War, to whom time was always a matter of the first consideration, had little patience for the delays incident on the production of an original sketch, and still less for those due to the processes of reproduction. But Napoleon himself was one of the principal difficulties with which the corps had to contend. The author relates that, during the campaign of 1813 in Silesia, a waggon containing maps having been lost, it became necessary to send to Paris by special express for all available topographical information. The only map in the possession of the department, of which a rough tracing for the engraver had been taken, was sent, and Napoleon, once in possession of it, refused to give it up, although, without it, it was impossible to proceed with the engraving. After it had been in his hands a month, the chief of the Topographical Department ventured to ask for it; but before he had uttered two words, Napoleon stopped him with "*Vous raisonnez comme un Ingénieur Géographe vous! J'ai besoin de tout, e plus même, s'il y en a.*"

Napoleon, however, was the first to grant military rank to the corps, in 1809, and he decreed about the same time that it was in future to be recruited exclusively from the École Polytechnique.

Amongst the most important topographical results of Napoleon's time was the map of Egypt, on a scale of $\frac{1}{100000}$ in forty-seven sheets, which is to this day a standard work. It was compiled during the Consulate from sketches made by the French troops during the occupation of Egypt, and from all available documents both ancient and modern. The engraving was completed in 1808; but Napoleon then directed that it should remain a State secret document. In 1814 it was decided to publish the map, but it did not come into the hands of the public till 1820.

In 1831 the corps of *Ingénieurs Géographes* ceased to exist. Its members were incorporated into the General Staff of the army, and under another title their work is continued at the present time. Colonel Berthaut is not in favour of the reconstitution of a special corps of topographers on several grounds, but mainly because, in the interests of the education of officers in general, it is better that the study of topography should be encouraged amongst all ranks than that it should be restricted to a selected body. Whilst agreeing in this view, it is difficult to avoid the conclusion that the institution of the *Ingénieurs Géographes* in France has had much to do with the leading position she has taken in matters of topography, and with the example she has offered to other nations by giving to the world maps of all countries in which her soldiers have served.

J. K. T.

A Cartographic Annual.

'L'Année Cartographique. Supplément annuel à toutes les publications de Géographie et de Cartographie.' Dressé et rédigé sous la direction de F. Schrader. Douzième supplément contenant les modifications géographiques et politiques des années 1900–1901. Paris: Hachette et Cie. 1903. *Price* 3 *fr.*

This useful publication has now reached its twelfth year of issue, and in the present number the principal geographical explorations during the years 1900–1901 are dealt with. There are three sheets of maps, one devoted to Asia, another to Africa, and the third to America. Upon the first there are four maps and an inset showing the route and surveys of the Kozloff expedition through Mongolia and Tibet, those of Mr. R. Logan-Jack in Sechuan and Yunnan, and of Mr. Barclay Parsons from Hankau to Canton. There is also a small map of the French railway under construction between Lao-Kai in Tonking to Yunnan. The second

sheet contains a general map of Africa, illustrating the progress of railway development in 1901, maps showing the routes of recent explorers in the region of the upper Nile and Southern Ethiopia, the route of Mr. P. H. Selby in North-East Rhodesia, the explorations of MM. Bos and Superville in the region of the upper Ubangi, and of M. Lesieur in the French Congo district. On the American sheet there are maps of Canada and the United States, showing the progress of the Government surveys; Honduras, from the surveys of Dr. K. Sapper; and a part of Eastern Bolivia, from the maps showing the explorations of Colonel J. M. Pando and Sir Martin Conway given in the *Geographical Journal*. It is interesting and satisfactory to note that no less than five of the maps contained in this issue have been taken from those published in the *Geographical Journal*, in addition to which there is other evidence of the fact that this Society's publication has been freely used.

Upon the back of each sheet is given a short description of the maps and an account of each of the explorations and surveys they illustrate. It is clear that M. Schrader has made good use of the very limited space at his disposal, and the leading geographical facts connected with the various journeys are mentioned. The remarkable error of about two degrees of latitude which exists in the original maps of the southern section of the Kozloff expedition is referred to, and other matters of an interesting and important character are dealt with. Altogether the present issue of the 'Année Cartographique' will doubtless prove useful for general reference, and it is only to be regretted that it is not further extended and rendered more complete.

GENERAL.

Naturalist Travel.

'Aus den Wanderjahren eines Naturforschers.' Von Ernst Hartert. Berlin, London, and the Hague. 1901–1902.

This is a readable volume, made up of sketches of travel, mostly in the tropics, undertaken in various years from 1885 onwards, for purposes of zoological collecting and research. In the year mentioned the well-known German explorer, Flegel, was organizing his last fatal expedition to the regions of the Niger and Benue on behalf of the German African Association, and Mr. Hartert, then a young zoologist eager to make acquaintance with the marvels of tropical nature, volunteered to accompany the party as collector of natural history specimens. Another volunteer was Dr. Staudinger, to whom and Mr. Hartert it eventually fell, owing to the illness of other members of the expedition, to carry through the most important part of its programme—the journey from the Benue overland to Kano and Sokoto, for the presentation to the Emirs of those cities of letters from the German Emperor. The account of this journey forms the first item in the present volume, and the most important from a geographical point of view. The Hausa countries were then much less known than at present, and as the route from Zaria to Sokoto was one which had never been traversed by a European, the results were of some importance. They have, of course, been long since made public, both in scientific papers and in the work of Dr. Staudinger published in 1889, but Mr. Hartert's observations on the country traversed, its natural history, people and prospects, are of interest at a time when so much attention is being directed to the countries in question. The main ornithological, botanical, and other scientific results of the journey are recorded in special chapters. Some of the collections have unfortunately been dispersed without being properly described, and so little is really known of the zoology of the Hausa countries that Mr. Hartert promises a rich harvest to any naturalist who may make use of the newly gained facilities for research in those regions. Other journeys described in the volume took the author to south-east

Asia (India, Sumatra, and Perak, described as a veritable naturalist's paradise), the West Indies, the Canary islands, and Morocco, and though these of course yielded no geographical novelties, the narrative is always interesting, and shows once more the advantages which a scientific training affords to a traveller, both as regards his own enjoyment and his power of supplying instruction to the public.

Early Voyages.

'An English Garner. Voyages and Travels mainly during the 16th and 17th Centuries.' With an introduction by C. Raymond Beazley. Two vols. Westminster: Constable. 1903.

These volumes consist of a reprint of the early narratives of travel contained in the 'English Garner,' issued by Prof. Arber between 1877 and 1890. They were there interspersed among other early literature, but have now been placed in a separate section of their own, and their re-issue in this form will no doubt be welcome to such readers among the general public as may wish to gain a general knowledge of the work of early English travellers without referring to such bulky and expensive works as Hakluyt's Voyages or the publications of the Hakluyt Society. Mr. Beazley's introductions, which are judiciously concise and to the purpose, will be an assistance to a right comprehension of the individuality of the travellers, the circumstances under which the journeys were made, and their contribution to the extension of knowledge. The greater part of the narratives are from Hakluyt (*e.g.* those of the Hawkins' voyages, Thomas Stevens' voyage to India, Cavendish's voyage round the world, etc.), but a condensed version of Linschoten, Wright's 'Voyage of the Earl of Cumberland to the Azores,' Knox's 'Captivity in the Highlands of Ceylon,' and some others, are also included. The modernizing of the spelling is perhaps to be regretted as detracting somewhat from the old-time flavour afforded by the narratives in their original form. Due though it may be to a lamentable (?) want of education, the quaint spelling of the old writers helps the reader not a little to transport himself back into the atmosphere of former times, which is to many one of the chief charms of such old narratives.

THE MONTHLY RECORD.

EUROPE.

Changes on the Coast-line of Brittany.—Various phenomena on the west coast of Brittany have led some writers to conclude that a gradual sinking of the land has been, and still is, taking place on that coast. The main reasons for this belief have been (1) the recent separation from the mainland of the archipelago or small islands to the south-east of Ushant; (2) the existence of submerged forest at Treompan, Goulven, and other points along the north coast of Léon; (3) the occurrence of supposed megalithic monuments below high-water mark, together with the legends respecting the ancient destruction of certain towns, and the actual engulfment of Tréoultié-Penmarch about 1530. In a note contributed to the *Annales de Géographie* (January 15, 1903), Prof. C. Vallaux shows reasons for doubting the conclusions drawn from each of these lines of argument, holding that the observed facts can be quite well explained as the outcome of marine erosion and allied phenomena. He points out that the former plateau, of which Molène and the other islets south-east of Ushant are the scanty remnants, was composed of the granites injected into the core of the primitive Léon anticlinal, which are particularly liable to degradation, as is to be seen in the "Grève de Goulven," where an

area of 20 square kilometres of a similar granite has been entirely reduced to sand. As regards the submerged forests, he quotes a description by the careful observer La Fruglaye (1811), as proving that the trees grew in a moist and spongy soil, hardly raised above sea-level; and maintains that an invasion of the sea could well be brought about in such cases by the erosion of a previously existing barrier or the landward displacement of a line of dunes. The same explanation would apply to the now partially submerged monoliths, so far as these are genuine, while many supposed monuments of the kind are really, it is held, the result of natural forces The legend respecting ancient cities (Ys, Tolente) are also discredited. The writer does not deny that occasional movements may have taken place, but he maintains that these were entirely local, and did not affect the whole area at the same time.

The Popovo Polje in Herzegovina.—Dr. F. Katzer gives in *Globus* (vol. 83, No. 12) an interesting account of the Popovo "polje," which occupies the north-western end of a depression in the Karst region of Bosnia and Herzegovina, of which the total length is some 30 miles, the breadth varying between 1 and 5. The central portion of this depression is more elevated than the two ends, which are both occupied by poljes, but the whole is traversed by the Trebinjčica, which makes its exit from the limestone as a considerable stream at the upper end of the valley, and resumes its underground course at the lower end. In summer the polje is drained by this and other underground channels, and the fertile deposit left by the water is then cultivated; but in autumn and winter, when the channels are unable to carry off the excess of water fast enough, the polje is converted into a lake 130 feet deep in places. The area is liable to be flooded at any time of the year, and it has been known that cultivation has been impossible for several years together. Besides the channel by which the Trebinjčica makes its exit, the principal outlet for the water is the Doljašnica "ponor," but as its mouth is some 25 feet above the level of the nearest point of the Trebinjčica, the inundation reaches a certain point before it comes into play. Dr. Katzer discusses the mode of origin of the depression, which has all the characters of a transverse valley, and must originally have been drained by a sub-aërial stream. He concludes that the basin was cut off from connection with the sea by the elevation of the intervening anticline, with which the wearing down of the former river-bed could not keep pace. This must have taken place at the end of the Pliocene period, or even later.

Distribution of Population in Wallachia.—M. Emm. de Martonne has investigated the distribution of the people of this province, drawing his data chiefly from the results of the census of 1899 and the *Indicator al comunelor urbane si rurale*. His map, published in the bulletin of the Roumanian Geographical Society, is based on natural districts, and the towns are distinguished by various signs according to their populations. Bukarest, the capital, contains 282,071 inhabitants, and there are, besides, five towns of more than 40,000 inhabitants, six with more than 20,000, and fifteen with more than 10,000, the aggregate population of all these constituting about nineteen per cent. of the population of Wallachia. The province is, however, almost entirely agricultural, and the towns are rather huge villages with few continuous streets, and the inhabitants of the suburbs gain their living by agricultural pursuits. Therefore, in calculating the district populations, M. de Martonne has not entirely eliminated the towns, but has included a certain part of their population in the country population. For instance, the small towns of 6000 to 20,000 inhabitants are reckoned at 6000 each, while for the highest class of over 200,000, containing only one town, Bukarest, 20,000 is taken. As the Bukarest municipal area covers 55 sq. kiloms., the density on this basis is less than 400 to the square kilometre (941 to the square mile), or not

greater than that of some of the upland valleys. Thus reduced, the population of Wallachia is 2,061,020, and the density 39·5 (102 to the square mile), while the density with the whole population of the towns included is 50 (129·5 per square mile). There are in Wallachia two chief zones of high density, the one skirting the foot of the Carpathians, the other following the course of the Danube. The former is the region of the earliest settlements, is particularly fertile and well watered, and contains the mineral wealth of Roumania, salt and petroleum, while the Danube valley is not only a great commercial highway, but is also well supplied with water, which, on the diluvial terraces to the north, has to be drawn up from deep wells. In the upland zone the density is 142 to the square mile; in the Danube valley it is reduced by the marshes of Balta to only 75·4. The diluvial terrace has a fertile soil, but an insufficient water-supply; nevertheless the density of population reaches 102·6, about the average for Wallachia. The hilly region, with 43 per cent. of the total population in 30·7 per cent. of the area, has a density above the average, while in the mountains there are only 12·2 inhabitants to the square mile, closely concentrated in the valleys. In much the same condition are the low terraces of Baragan and Buzeu, where water is hard to obtain except in the valleys. One of the most densely peopled districts of Wallachia is the Prahova valley, with 19,000 inhabitants and a density of 961. It is the great centre of the petroleum industry, and since the Predeal railway has been opened, one of the most frequented international routes in the country. The Teleajna valley is almost as thickly peopled, owing to the immense fertility of its soil. M. de Martonne also shows the grouping of the population by a map based on the average population of the *cătun*, a subdivison of the Commune, in each region.

ASIA.

Explorations in Asia Minor.—Dr. Leonhard, of Breslau, has extended his investigations in Northern Asia Minor (*Geographical Journal*, February, 1900, p. 175) to the examination of the ancient tombs in the region. His results, published in the eightieth annual report of the *Schlesischen Gesellschaft für vaterlandische Kultur*, under the title "Paphlagonische Denkmaler (Tumuli, Felsengräber, Befestigungen)," deal specially with tumuli and rock tombs, the two kinds of burial-places which distinguish two ancient civilizations found in Asia Minor. Tumuli occur only in the great plains. Ramsay, and later A. Koerte, found them in ancient Phrygia; Leonhard now shows that they exist in Paphlagonia, extending their range considerably to the north-east. According to Herodotus (v. 8), this mode of sepulture was in use amongst the Thracians on the western side of the Black sea: the body of a nobleman was buried or burnt, and a large tumulus heaped upon the spot. The custom was thus probably introduced into Asia Minor from Thrace, and is an importation. The rock tombs, on the other hand, are peculiar to the peninsula; they are only known elsewhere in Egypt, of the time of the middle kingdom. Their use may have been due originally to the large number of natural cavities occurring in the rocks of Asia Minor, especially the limestones and recent eruptive rocks. The rock tombs of Paphlagonia are probably the most ancient; they were first discovered by Hamilton in 1835, and worked out systematically by Hirschfeld. Leonhard regards them as remains of an independent development from Hittite practice, the relation of which to the ancient Babylonian civilization has recently been demonstrated by E. Chantre. Leonhard finds evidence of the Hittite style of the Paphlagonian tombs in two chambers discovered recently by himself, one at Salarköj, and the other at Suleimanköj. Both have the peculiarly appropriate positions, in harmony with their surroundings, characteristic of the Paphlagonian tombs. Although

the point is hardly geographical, it is interesting to note that Leonhard believes one of the pictures in the antechamber of the Kalekapu tomb to represent a unicorn; this would be the earliest record of the fabulous animal, which is chiefly found in the pictures of the Middle Ages and in English coats-of-arms. Nearly all known heraldic beasts occur in Hittite art, including the prototypes of the Russian and Austrian double eagle. The geographical nature of the country, with its steep forest-clad slopes to the Black sea, prevented the Greek colonies (Sinope) from extending their influence into the interior in pre-Alexandrian days; on the contrary, traces of Hittite civilization made their way through Phrygia to Greece, where the Mycenæan culture shows unmistakable signs of relationship to the older or contemporary culture of Asia Minor. The irruption of the Cimmerians seems to have marked the end of the development of culture in Paphlagonia and Cappadocia, hence the last Paphlagonian rock tombs are probably not older than 700 B.C.

Explorations in the Kashmir Himalayas.—One of the finest but least-known mountain groups in the Kashmir Himalayas is that of the Nun Kun, which culminates in the twin peaks of Ser and Mer, both nearly 23,500 feet high. This has lately been explored by Dr. A. Neve and the Rev. C. E. Barton, the former of whom describes the journey in the *Alpine Journal* for February of this year. The time occupied by the trip was only a month, including the route from and to Srinagar across several snow-passes, so that a thorough exploration of the district was impossible; nor was any attempt made on the peaks themselves, which have generally been put down as inaccessible by reason of their vast outlying precipices. Some additions were, however, made to our knowledge of the topography of the district. From Suru, where a set of sturdy Ladaki porters were taken on in place of the Kashmiris, the route led first east-south-east up the valley of the Suru river, and then south up that of its tributary the Shafat-chu to the foot of the great glacier which descends on the east of the Nun Kun. From the summit of the Pukartse La, on the spur which causes the Suru to make a wide sweep to the south, one of the grandest mountain views in the world is obtained, the more southern of the twin peaks standing out clearly by itself at the head of the great Ganri glacier, and presenting from this side a dome-shaped outline. In the Shafat valley it was found that the main glacier extends 2 or 3 miles lower down than it is marked on the Survey map—a fact which is not wholly to be explained by a recent advance, though of this there were some traces. The glacier was followed up to the snow-field between the two peaks, a night being spent at 15,000 feet, and 18,000 feet reached the next day, the last part of the route being up a great sloping ice-wall. Returning to Suru, the travellers made a fresh start in a southerly direction, in part along the bend of the Suru river, which here flows in a natural tunnel, covered in by fallen boulders. Ascending to the rocky ridge, called by the guide the Sentik La (16,500 feet), it was found that D 41 of the map is merely the west buttress of the great dome of the Nun Kun, which rises on this side from a snow-field nearly 19,000 feet above the sea. To the south and west the travellers looked, not, as might be supposed from the Survey map, down into the Wardwan valleys, but on to a vast snow-field, which runs down west from Nun Kun, and is in places 2 or 3 miles wide. Beyond this the Barmal La was crossed, and a descent made in safety, though with some difficulty in the case of the laden porters, into one of the deep Wardwan valleys, and so *viâ* the Mongil and Margan passes to the valley of Kashmir.

AFRICA.

The Semna Cataract of the Nile.—A careful study of the Nile rapids at Semna, between the second and third cataracts, has lately been made by Mr. J. Ball, of the Geological Survey of Egypt, with a view to throwing light on the

physical changes which have taken place within the historic period. The results are put forward in a paper published in the *Quarterly Journal* of the Geological Society for February 10, 1903 (vol. lix. part i.). It was first made known by the researches of Lepsius during his expedition of 1842–45, that the then high-water level of the Nile at Semna was about 24 feet lower than the level indicated by the sculptured marks on the rocks at Semna, and the problem presented by this fact was in 1850 suggested by Horner, a former president of the Geological Society, as an interesting subject for elucidation by any geologist who might visit the spot. No such investigation seems, however, to have been made until the visit of Mr. Ball last year. Above and below the site of the temple ruins at Semna and Kumna, the Nile has a breadth of about 1300 feet, but between the two temples a narrow band of hard red and grey gneiss forms a natural barrier across the stream. At high Nile the river flows over this barrier with but slight diminution of width, though with increased velocity and violent eddies. But at low Nile the gneiss band entirely bars the stream, except for a narrow central channel about 130 feet in width. The gneiss of the barrier is very hard, with well-marked foliation planes striking parallel to the direction of the river. The portion laid bare at low water is honeycombed with large pot-holes, which bear witness to the powerful grinding action of the stream in flood. No trace was found of the existence of a soft basic dyke such as accounts for most of the channels at Assuan, and Mr. Ball is of opinion that both the deep central channel and the smaller channels, filled only at high water, are due simply to the erosive action of the river, the flow of which coincides in direction with the strike of the foliation planes of the gneiss. He considers that the change of level above alluded to (which has taken place within a period of about 4200 years) can be quite well explained as a result of the wearing away of the barrier by erosion. The vertical extent of such erosion works out at about 2 millimetres per year, which corresponds to the removal of only 5 milligrammes of rock per ton of silt-laden water, and of this Mr. Ball thinks that at least two-thirds is accounted for by the pot-holing action. Similar studies at other points have thrown much light on the past changes in the course of the river; and from the deep soundings which have been found below the new dam at Assuan, it seems possible that the classical descriptions of the Assuan cataract as a distinct waterfall may have more foundation than has been supposed.

Surveys on the Upper Nile.—With reference to the surveys lately executed by Major Delmé Radcliffe in the Nile province of the Uganda Protectorate (*ante*, p. 162, and map), a correspondent points out that a survey of the Nile below its exit from the Albert Nyanza was carried out by General Gordon, when governor of the Egyptian Sudan, and that his original map was in the hands of a Belgian missionary not many years ago. Maps showing the results of Gordon's survey were published in vol. i. of the *Bulletin* of the Khedivial Geographical Society, and (on a reduced scale) in vol. xlvi. of the *Journal* of our Society, as well as in the *Geographical Magazine* for 1877. It is also pointed out in *Globus* (No. 14, 1903) that the surveys executed by Emin Pasha in the equatorial province, though not based on astronomical observations, agree on the whole well with those of Major Radcliffe, both as regards the positions of Dufile, Fatiko, and Fadibek, the altitudes, and the course of the Nile between Dufile and the Albert lake. In particular, the courses of the Ateppi, Unyame, and Eyuppe agree well in the two surveys.

Balloon Experiment in North Africa.—The French officer generally known by the *nom-de-plume* of Léo-Dex has for some years been attacking the problem of the possibility of crossing the Sahara in a balloon, and for the purpose of experiment, he, at the close of last year, with several coadjutors, went to Gabes with a view to launching a pilot balloon in the hopes that it might be taken by

the local wind currents into the region of the trade winds, and so be carried across the Sahara to Timbuktu (*Tour du Monde*, 1903, No. 12). This result was not attained, though the balloon made a journey of several hundred miles before coming to the ground in Southern Algeria. From the direction taken by it in its voyage, it appears that the wind, which often blows steadily in winter in the neighbourhood of Gabes for considerable periods, assumed an easterly direction above the sands of the great Erg, and, carrying the balloon westward in about 32°, finally veered still more and carried it northward to a point on the Wed Jedi, a little north of 34°, when it was brought to the ground by the Arabs by means of the guide-ropes. A similar attempt might in other circumstances meet with success, for, as the influence of the regular trade winds begins to be felt in this region in about 30°, the local currents would have to be maintained only some 2° further to the south in order to bring a balloon within the sphere of action of the trades.

Prof. Fischer's Explorations in Morocco.—Prof. Theobald Fischer's important researches in the Atlas Vorland of Morocco are completed by the account of his third journey in that region, published in the *Mitteilungen* of the Hamburg Geographical Society (vol. xviii.). The journey, which extended over some three and a half months, was made in the early part of 1901. Prof. Fischer was accompanied by Dr. Weisgerber, who had been in medical practice for four years in Casablanca, and was familiar with many aspects of the region traversed, and by Dr. G. Kampffmeyer, of the University of Marburg. The main objects of the expedition, which were for the most part successfully accomplished, were the examination of the fertile "black earth" region in the coast provinces Abda, Dukkala, and Schauia. Each province was crossed once from the coast to the interior and back. Another feature was the exploration of the unknown course of the Um-er-Rbia below Meshra-esch-Schaêr, where Prof. Fischer had to leave the river in 1899; this also has been substantially completed, although it was impossible to keep to the stream closely throughout, on account of the difficult nature of the country. As a type of the land-form found, the river-loop at Bu-el-Awân was minutely surveyed on a scale of 1 : 100,000. Bu-el-Awân is a ruined fortress, which has not hitherto been visited by a European, although in the end of the eighteenth century Dr. Lemprière saw it from a distance. In view of the important commercial relations existing between Hamburg and Morocco, Prof. Fischer devoted special attention to the trade possibilities of the country, making considerable stays in Mogador and Casablanca, and drawing a new plan of the former town on a scale of 1 : 10,000. The excursions into the interior also gave an opportunity of adding considerably to our knowledge of the provinces of Schedma and Ahmar. Schedma is a relatively poor province, of which Mogador is the capital. Ahmar belongs to the second step of the Atlas Vorland, rising steeply from the plain of Abda to a height of about 400 metres, and having the Zyma lake as its chief feature. Two minor objects of the expedition had to be abandoned, chiefly on account of political difficulties: the making of excavations in the slag-heaps and barrows at Aïn-el-Hadschar in Schedma, in order to determine the nationality of the former workers in iron, whom Prof. Fischer supposes to have been Phœnicians; and exploration of the Djebel Zerhun, a small mountain district between Miknâs and Fâs, inhabited by practically independent Berbers. Incidentally, an important result of the expedition is the establishment of meteorological observing stations at Casablanca and Marrakesch. We are only able to give the main outlines of Prof. Fischer's account of his arduous and sometimes dangerous work: it is scarcely necessary to add that his narrative abounds in accurate detail of all kinds—analyses of soils, determinations of heights, and the like.

The French Colonies of Guinea with Respect to Colonization.—Dr.

Barot describes (*La Géographie*, No. 1, 1903) the natural conditions of the West African colonies with the object of determining their adaptability for European colonization. The mountain system he describes as consisting of three ranges parallel to one another and following the outline of the coast. These are crossed in a direction from south-west to north-east by five lines of folding, which constitute watersheds, except the third, traversed by the rivers Comoe and N'Zi. The isothermic lines run parallel to the mountain ranges, but it is singular that the mean annual temperature decreases towards the equator. On the Senegal, where there is little rain—8 inches in the year—the east winds from the Sahara raise the temperature sometimes to 107° Fahr. South of lat. 40° the mountains turn aside these easterly winds and arrest the clouds, so that the annual rainfall rises suddenly to 24 inches. Below lat. 9° the rainfall is 52 inches, and on the coast plateau more than 78 inches. Here the temperature is modified by the dense clouds, but the atmosphere is saturated with moisture. The coastal zone is covered with tangled forest, whereas on the plateaus of the upper Niger, Volta, and Senegal the vegetation is luxuriant without being rank. Natural products, such as vegetable butter, indiarubber, palm-oil, kola-nuts, ground-nuts, etc., are mingled with European vegetables and American cereals. North of lat. 14° there are only steppes covered with scanty grass and stunted trees, or the sands of the Sahara. On the plateaus also are concentrated the greater number of the native inhabitants. During the last quarter of a century, however, they have been decimated by the wars and slave-raids of Samory, Babemba, and other chiefs, and the villages and towns have dwindled. Kong, which in 1887 excited the astonishment of Binger, now hardly exists. For Europeans these plateaus are as healthy as Algeria. During the doctor's service with two columns the mortality was only 15 per thousand, and the number of serious cases of disease only 80. The most favourable zone lies around the upper Niger and its affluents at an elevation of 650 to 1300 feet, and has an area of some 58,000 square miles. It is well watered and extremely fertile. Somewhat less desirable, because it slopes to the west or south, is the region watered by the upper waters of the Bakoi, Bandama, Komoe, Volta, and Weme, with an area of 154,000 square miles. A third zone, fairly good, is divided into two, and consists of French Guinea and Futa Jallon on the west, 13,500 square miles, and the basins of the upper Sassandra and of the middle Bandama, Comoe, and the Voltas, about 108,000 square miles. Together these three zones cover an area of about 333,000 square miles, of which 270,000 are in French territory.

French Surveys in the Lake Chad Region.—The surveys carried out in the region of Lake Chad by Colonel Destenave and officers under his orders have already been briefly referred to in the *Journal*, and fuller details have now been supplied in several publications, including the *Comptes Rendus* of the Academy of Sciences (1903, p. 575), *La Géographie* (March, 1603), and the *Revue Coloniale* (1902, p. 331). The surveys have dealt not only with the shores of the lake itself and its islands, which have now for the first time been delineated with any accuracy, but with the region of the Lower Shari and that to the east of the lake on either side of the Bahr-el-Ghazal depression. The islands are arranged in two main groups, the Kuri archipelago, occupying the great eastern bay, and that of Buduma, which fringes the coast of Kanem from 13° 30′ N. lat. They form an immense littoral system, the individual parts of which are disposed in a north-north-west direction, this being the resultant of the directions of the two prevailing winds in this region. The islands are generally low and composed of sands and clays deposited by the Harmattan or north-east wind. Some are inhabited, and rise in sandhills to a height of 35 to 50 feet above the water. Others are covered with pastures, and reach a height of 12 to 16 feet; while a third type

consists of low islands rising only 1 or 1½ foot above the lake. As is the rule with the lakes of sandy desert regions, Chad appears subject to a displacement in the direction of the dominant winds, a silting up being observable in the east and north-east, while the waters are extending towards the west and south-west—in which direction the greatest depths (about 40 feet) occur, those in the east reaching only 12 to 16 feet. Among the items of geographical work (in addition to the survey of the islands) accomplished by the officers under Colonel Destenave, some of the most important are: (1) The fixing of the geographical co-ordinates of various points, by Lieut. Huart, the latitudes being obtained by circum-meridian altitudes of stars, the longitudes by the transport of time in a closed circuit; (2) observations of the level of the lake near the mouth of the Shari, during the months of February to April, 1902 (the variations were found to be in direct relation with the direction and force of the winds, the maximum reaching 10½ inches (0·27 metre)); (3) the detailed examination of the south-east shore of the lake by Captain Dubois, with a study of the vicissitudes to which the Bahr-el-Ghazal has been subject, down to its abandonment by the lake waters. The valley of the Bahr-el-Ghazal and the country to the north of it have also been carefully studied by other officers. Various contributions to our knowledge of the hydrography of the Shari have also been made, while reconnaissances have been carried out both in Kanem and Wadai, those in the latter being of special interest by reason of the scantiness of our information respecting the geography of the country. Lake Fettri, or Fittri, was reached by Lieut. Avon, who places it in about 12° 40′ N., 17° 40′ E., or in very nearly the position it has hitherto occupied on our maps. Geological, biological, and ethnological observations have also been made, the geological specimens showing the abundance of eruptive rocks in the region explored. The Kuri and Buduma archipelagoes are estimated to contain, respectively, populations of 19,000 and 17,000 souls.

German Expeditions between the Benue and Lake Chad.—The expedition of Colonel Pavel, by which German authority was first established in the northern parts of the Kamerun territory, has been followed by others, which have added considerably to our knowledge of the country. Lieut. Dominik, who has traversed the region between the Benue and Lake Chad by various routes, gives, in the *Deutsches Kolonialblatt* (Nos. 5–7, 1903), a detailed account of the country, which is valuable as giving trustworthy information as to the present political situation in German Bornu, as well as of the relations of the various elements which compose its mixed population. He divides the region described into three main natural divisions: (1) Adamawa proper, including the river-areas of the Mayo Kebbe and Mayo Lue and the mountain massifs to the north; (2) the isolated mountain district of Mandara; and (3) the lowlands, which may be divided again into German Bornu and the Pagan districts extending east to the Shari. Adamawa, though properly a political division, corresponds also, he considers, with a natural division of the region. The fertile Benue valley is shut in on the north by a sandstone plateau, the river flowing in a bed some 300 yards wide, and offering no hindrance to navigation between July and September, though in October it falls rapidly, and at this time its tributary, the Faro, shows in places no water at all above its sandy bed. The two main caravan routes to the north run one on each side of the Tengelin massif, which stretches north of Garua, and is inhabited by the Pagan Falli stock. Lieut. Dominik traversed the northern lowlands by three different routes, the two western leading to Dikwa, the capital of German Bornu, the easternmost to Lake Chad by the lower Logone. The shores of the lake are more or less swampy throughout a zone of some miles, the passage from firm ground to the open water being very gradual. Clouds constantly hang over the

water, being caused by the desert sand from the north, which gives rise to a succession of sand-dunes traversing the black-earth plain to the south. Between the lake and Dikwa village follows village very closely. The land is fertile, and the Kanuri especially live well, great plenty prevailing in Dikwa. The writer considers that, owing to its central position, Bornu must always maintain its importance as the meeting-ground of Mohammedans from the north, south, east, and west. Further south, on the headwaters of the Benue, some entirely new ground has been broken by the expedition despatched by the "Niger-Benue-Lake Chad Committee" (*D. Kolonialzeitung*, No. 13). At Rei Ruba, the capital of Bubanjidda, where the first German Kamerun expedition met with a check from the hostility of the king, the expedition was accorded a particularly friendly reception. The town is surrounded by a wall and ditch, and the Fulbe of Bubanjidda are as warlike as any in German Adamawa. Hence the hitherto unknown tract extending to the French frontier was explored, and was found to consist of a mountainous country cut up by streams which flow to the Mao Shuffi, an important tributary of the upper Benue not marked on existing maps. The geological formation is principally granite. The route was continued south to Ngaumdere, whence the expedition returned to Garua.

AMERICA.

The Level of the Great Salt Lake.—The progressive fall in the level of the Great Salt lake continues to attract attention, fears being expressed in some quarters that if the shrinkage is maintained much longer, the lake may dry up entirely. Among writers who have discussed the cause of the fall in the level is Mr. L. H. Murdoch, of the U.S. Weather Bureau, who sums up his conclusions in the *National Geographic Magazine* for February last, having entered more fully into the meteorological factors involved in the *Monthly Weather Review* for October, 1902. The fall in the lake-level has been particularly rapid during the last three years, the deficiency of precipitation having also been most marked during the same period, though the present dry cycle has lasted since 1887. On December 1 last, the reading of the gauge at Garfield beach was 5 feet 11 inches below the zero of the scale, showing a fall of 11 feet 7 inches since the close of 1886, the year in which the last rise terminated, and a level between 3 and 4 feet below that of 1847. The last wet cycle lasted from 1865 to 1886, during which the lake rose to about 13 feet above the zero mark (in 1868 and again in 1876). The annual precipitation averaged 18·42 inches, or 1·77 above the normal, during this period; while for the years 1887–1902 the average has been 14·8 inches, or 1·85 inch below the normal. Mr. Murdoch considers that even were this low rainfall to be maintained, the level would not fall without limit, but that a balance would in time be reached between the area of the lake and its inflow, and the decline would then terminate. The large deficiency of 29·6 inches in precipitation during the last sixteen years seems certainly the main cause of the fall of the lake, for the possible loss from irrigating 609 square miles of land must be very small by comparison.

The Eruption of Santa Maria in Guatemala.—Dr. Sapper arrived in Guatemala on the day on which the eruptions commenced, and immediately hastened to the seat of devastation. The area over which more than 20 cms. (nearly 8 inches) of ashes and pumicestone have fallen extends to about 2000 square miles, and within it most of the houses and farm buildings have fallen in under the weight of the ejectamenta, and in some places are totally destroyed. Several hundred persons must have been killed. The damage done to crops is enormous, especially in the coffee districts of Xolhuitz and Costa Cuca. Many plantations have been definitely abandoned, and many others cannot probably be restored.—*Zeitschrift der Gesell. für Erdkunde zu Berlin*, No. 1, 1903.

The Caura Territory in Venezuelan Guiana.—In the winter of 1901–02 Dr. Passarge visited the country between the Caura and Cuchivero rivers, examining a region 2500 square miles in area. On the way to the Caura the longitude of Bolivar was ascertained to be 63° 39′ 13″ W., or only 2¼′ less than on Sievers' map. The longitude of Alta Gracia, however, 63° 37′ 15″, differs by $\frac{1}{3}$° from Humboldt's survey, on which all the present maps are based, and therefore the whole basin of the upper Orinoco should be displaced $\frac{1}{3}$° to the east. The Caura river has a breadth of 1200 yards at its mouth, and of 650 to 850 further up. The Cuchivero issues from the Guiana mountains at the Raudal Alto, and expands from a breadth of 65–100 yards to 160–220. Below Las Lajitas there are no obstacles to navigation, and small steamers can ascend the river in the rainy season. The Sipao, a tributary of the Caura, and the Tucuragua are also navigable by canoes. The southern limit of the district explored is formed by the gneissic plateau of the Guiana highlands, which northwards sinks down below the level of the Llanos. Isolated groups of hills, almost entirely composed of granitic rocks, intervene between the Guiana highlands and the Llanos steppes, which extend from the cordillera of northern Venezuela across the Orinoco. These Llanos do not pass imperceptibly into the delta of the Orinoco, but 14 to 18 miles west of Las Castillas end in a steep edge 160 to 260 feet high. Dr. Passarge was struck with the resemblance of the surface forms of the archæan mountains with that of many South African ranges. The laterite of the Llanos is of ancient origin, as is also the African laterite, and this fact suggests that there may have been a great period of laterite formation. Another interesting question is whether the Llanos are a salt or fresh-water deposit. The strata, of enormous depth at the foot of the cordillera, thin out towards the Guiana highlands, where they do not reach a thickness of 65 feet. The material, then, came chiefly from the former elevation. Was the latter a bare rocky region where little detritus was produced, or were transporting agents wanting? In connection with this question stands the circumstance that the Orinoco has moved sidewards to the Guiana mountains, and now lies between them and the Llanos. Its bed is cut in the Guiana rock, but in the plain of the Llanos, the bed-rock being observable in most parts of its course. As regards the steep edge of the Llanos plateau in the delta, it may be asked whether it is of tectonic origin or caused by erosion, and whether a negative displacement of the shore-line has assisted in its formation.—*Zeitschrift der Gesell. für Erdkunde zu Berlin*, No. 1, 1903.

The Temperature and Rainfall of the Argentine Republic.—Dr. Josef Chavanne has published a sketch of the meteorology of the Republic in the *Veröffentlichungen der D. Akad. Vereinigung zu Buenos Aires*, Bd. i. Heft vii. The temperature means are derived from observations during forty-five years, 1856–1900, and the rainfall from a period of forty years, 1861–1900. He divides the country into five climatic regions, of which three are subdivided into two sections each. The eastern region, lying between the Uruguay and Parana, and extending down to Viedma, is characterized by greater warmth in autumn than in spring, the maximum difference being 1°·6 Fahr. The chief cause of this phenomenon is the alternating influence of the warm Brazilian and cold Falkland currents. West of the coast region, the country from the forests of the Chaco in the north, and including the greater part of the pampas, is more than 4°·5 warmer in spring than in autumn, and has a greater annual range of temperature—maximum 29°. The region between the sierras of Aconquija and Ancasti and the outer ranges of the eastern cordillera, rising from 650 to more than 5900 feet above sea-level, consists largely of salt-pans and sand-dunes, where in January and February daily means of 88° are recorded and absolute extremes of 110° are not uncommon, while in July

the daily mean up to 2600 feet often falls nearly to freezing-point. A peculiarity of this region are the hot local winds called *zondas*, caused by the configuration of the country and the nature of the soil, which blow with great frequency and regularity in the summer months, and sometimes raise the temperature as much as 18° to 34°, and reduce the relative humidity to zero. The annual range of temperature reaches up to 29°, and the temperature of spring exceeds that of autumn by more than 4½°. The rainfall varies from 8 to 16 inches. At heights of 3000 to 3900 feet the climate is very beneficial to health. The northern Andine region has a small rainfall of less than 8 inches, 90 to 98 per cent. of which fall between October and April. The range of temperature is less than in the steppes and central zone, while the excess of heat in spring over the autumn temperature here reaches a maximum. The southern Andine region is marked by the occurrence of winter rains, an increase in the annual fall, a greater range of temperature, and relatively cold winters. The southern extremity of the republic is divided into the east and west Patagonian regions. Owing to the smaller breadth of the continent, the difference of temperature between the east and west coast is small, but there is still a difference of 1° to 3½° in favour of the former. The rainfall shows much greater variations. Whereas from the mouth of the Chubut to south of the Straits of Magellan it is under 10 inches, it is fully 16 inches on the Pacific coastal strip, and rises to as much as 31 inches in some valleys and lake-basins east of the Andes. A long series of observations has been made only in the Valle 16 de Octubre, where the range of temperature is 90·9° (max. in December and January, 95°; min. in July, 4°·1). In all seasons of the year, winds from the western quadrant predominate and penetrate to the plateaus of the east coast, bringing rain with them, while the east and north-east winds are dry. Staaten island, with its large rainfall and great humidity, belongs to the west Patagonian region, and exhibits to a marked degree the oceanic type. As a whole, the Argentine climate is intermediate between the sea and continental types, a purely continental climate not existing even in the steppe region.

POLAR REGIONS.

Antarctic Expeditions.—The destination of the expedition which was being organized by Dr. Charcot for research in the arctic regions has suddenly been changed in view of the interest aroused in the South Polar region by the various expeditions now at work in that quarter. It had been from the first hoped that the proposed arctic voyage might lead the way to a more important venture in the antarctic, and it has now been decided to abandon the original plan and substitute that of a voyage to the south. This will, of course, retard the date of departure somewhat, besides rendering it necessary to collect more funds, but it is hoped that the delay will not exceed a few weeks. The *Tour du Monde* (No. 19, 1903) prints the memorandum adopted by the committee to which the organization of the expedition has been entrusted, from which it appears that the scene of action will be Alexander land, south of Graham land, and that, besides researches in oceanography and the various branches of zoology, it is hoped to carry out more strictly geographical work, including explorations on the southern continent. It does not seem to be contemplated to spend a winter in the antarctic. With regard to the Swedish expedition, of the return of which news had before this been expected, the despatch of a relief expedition has been determined on, and the necessary funds have been voted by the Swedish Parliament.

The German Station on Kerguelen Island.—The observers left on Kerguelen island by the German Antarctic Expedition for the purpose of carrying out

observations of terrestrial magnetism, etc., simultaneously with those of the main expedition, have returned to Sydney, with the exception of Dr. Enzensperger, who, we regret to say, succumbed to beri-beri during the stay on the island. The party appear to have had a very trying time, and another of the staff, Dr. Werth, was also ill on arrival in Sydney. Hopes are, however, entertained of his recovery.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Subterranean Waters.—Dr. F. J. Fischer has collected in the *Abhand. der K.K. Geogr. Gesells. in Wien*, No. 5, 1902, a large number of examples of the interaction of sea and ground waters. About a third of the rain that falls on the land filters downwards or trickles through fissures until it reaches impermeable strata, over which it spreads, forming reservoirs for the supply of springs and underground rivers. In some cases these reservoirs are connected with the sea, and the pressure of the salt water holds up the water in the underground channels to a height above the sea-level corresponding to the lower specific gravity of fresh water. When, however, the upper level of the fresh water is raised equilibrium is disturbed, and fresh-water springs rise up near the shore. Such are found in all parts of the world. One, particularly described by Dr. Fischer, is the Polla di Cadimare, in the gulf of Spezia, which shoots up to a height of 60 feet from the sea bottom and forms a small hillock on the surface. The water that feeds it falls as rain on the Apennines 3 miles distant. The magnitude of the complicated systems of subterranean channels is a proof, in Mr. Martel's opinion, of a diminished supply of water on the surface, for such extensive erosion must have been the work of much greater volumes of water than flow over the land at the present time. Erosion is still at work, though on a lesser scale, and in many Karst lands the water-supply is becoming a serious difficulty. In Yucatan most of the inhabitants have to obtain water from cave springs 1000 feet below the surface. A curious case of sea-water penetrating into the land may be observed at the Argostoli peninsula, in the island of Cephalonia. Here more than 2,000,000 cubic feet of water disappear through the fissures of the rock, and it has been proved that this salt water lies at a level of 5 feet below the surface of the sea. What ultimately becomes of it has not yet been ascertained. It may be raised by lateral pressure and sucked up through narrow channels, more or less vertical, into underground streams of fresh water and reappear in the brackish springs of the island. But the discharge of these springs is quite out of proportion to the sea-water absorbed, most of which, therefore, must be carried underground to far distant points. Elsewhere, also, brackish springs are formed by suction, and break forth at no great height above sea-level. Another interaction of salt and fresh water is due to the tides. At high tide the sea-water dams up the fresh water in the subterranean channels, and thus causes it to rise in wells and springs. Generally such wells afford a larger supply of water at high than at ebb tide, but in some the reverse is the case. Thus a boring at Fulham, 318 feet deep, yields during flood tide 60 gallons of water, and during the ebb 80 gallons. Probably the pressure of the tide is transmitted to branches of the underground water-system at a considerable distance from the outlets to the river, and therefore the effect of the pressure does not manifest itself at the boring till long after high tide. Similarly in impermeable ground rain floods the country at once, whereas in Karst lands it runs underground, and reappears to flood the country after a considerable lapse of time.

OBITUARY.

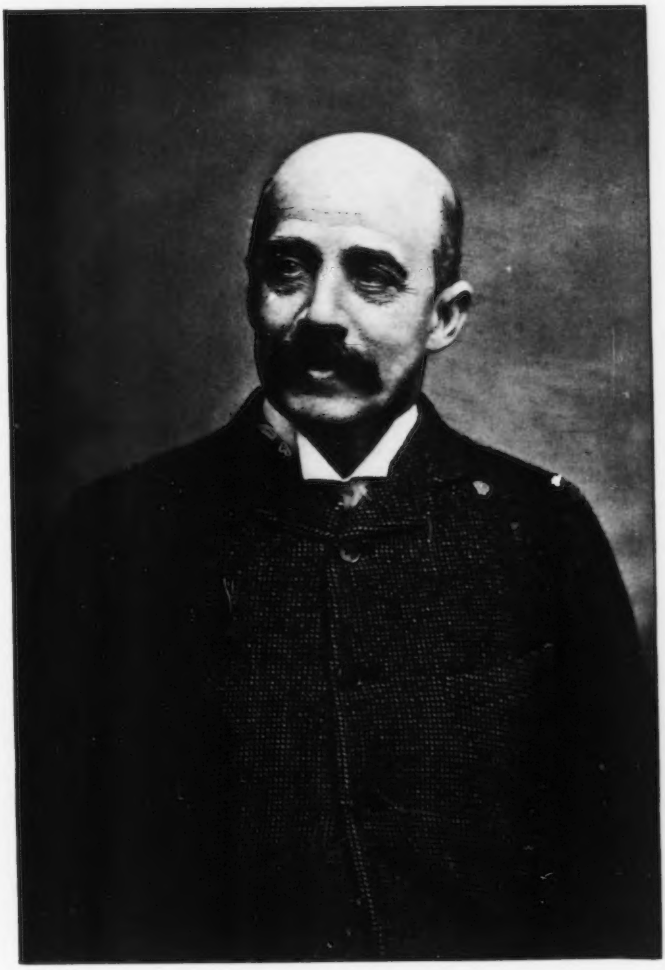
Paul Belloni du Chaillu.

P. B. du Chaillu, the distinguished African explorer, died at St. Petersburg on April 29. He was born in France * on July 31, 1835. His father having been appointed agent of Messrs. Oppenheim, of Paris, at the Gabon, where the French had built a fort in 1842, he accompanied him thither when still a boy. Such education as he received he owed to the missionaries established at the Gabon. But if facilities for a systematic course of instruction were wholly lacking in that out-of-the-way place, young Du Chaillu gained a thorough knowledge of native customs, acquired the language of the country, and became an expert sportsman, all of which proved of great service to him in his career. In 1852 he went to the United States with a natural history collection, the spoils of his gun, and, having attracted attention by a series of articles in the New York *Tribune*, he was entrusted by the Academy of Natural Sciences of Philadelphia with a mission to Western Africa.

He set out from New York in October, 1855, reached the Gabon in December, and up to June, 1859, carried on explorations which not only yielded rich and valuable zoological collections, fully described in the *Proceedings* of the American Academy, in whose service he travelled, but also extended most materially our geographical knowledge of a country at that time very little known. It is to Du Chaillu that geographers are indebted for the knowledge that the Muni, Munda, and the tributaries of the estuary of the Gabon are mere coast rivers, but that the St. Nazareth, Mexias, and Fernando Vaz are the deltaic arms of the Ogowe, a vast river rising far in the interior. Du Chaillu may, likewise, claim to have been the first European who killed a gorilla in his native wilds. The account of his 'Explorations and Adventures in Equatorial Africa' (London, 1861), a strikingly attractive volume of travels, was enthusiastically received by the general public, but severely criticized by a number of distinguished zoologists and geographers. The former questioned many of his statements as to the natural history of the country explored, and utterly refused to accept his statements as to the habits and ferocity of the gorilla. Among the latter, Dr. H. Barth (*Zeitschrift für Erdkunde*, vol. x., 1861) compared the dates in the published volume with those of letters previously published in America, and "regretfully" arrived at the conclusion that many of Du Chaillu's statements, more especially those referring to journeys into the interior, were fictitious (*erlogen*). The discrepancies in the dates are undeniable, but the confusion is due to the fact that Du Chaillu, at that time still a young man not fully master of English, and without experience as an author, sought the collaboration of a journalist, who thought fit to disregard the chronological order of events in favour of a geographical arrangement. It is obvious that if it had been intended to deceive the public, care would have been taken to arrange so simple a matter as the sequence of dates.

Du Chaillu, however, was not quite without supporters. Sir Richard Owen recognized the high value of his collections. Winwood Reid, whilst denying that Du Chaillu ever killed a gorilla, confirmed his accounts of the country and people; whilst Dr. Lenz does the same with special reference to the Muni, although he considers his predecessor's account to be "somewhat fantastic."

* In a lecture before the American Geographical Society, on January 5, 1860, he said:—"Before starting on my return I raised the flag of the United States, my country by adoption, and by its side the Tricolor of France, my native land."



PAUL B. DU CHAILLU.

From a photograph by Messrs. J. Thomson, 70a, Grosvenor Street, W.

Du Chaillu, naturally, was much irritated by the many doubts expressed as to his veracity, and being at the same time fully aware of his shortcomings as a scientific explorer, he underwent a course of instruction for making astronomical observations, and then resolved to return to the scene of his former labours. He expended nearly all the money obtained by the sale of his book to freight a ship, and left Gravesend on August 5, 1863, for the Fernando Vaz. At the very outset he met with a disaster, for on October 15 his boat was swamped in the surf, and most of his instruments were lost. A fresh supply had to be procured, and thus it was that his departure for the interior was delayed until October, 1867. Passing through the country of the Ashira, he crossed the great southern tributary of the Ogowe in the Apono country considerably higher up to what he had done during his first expedition, and discovered a village of Obongo dwarfs in the country of the Ishogo; but, unfortunately, the accidental killing of a native in an Ashango village by one of his followers led to hostilities, and Du Chaillu was compelled to beat a hasty retreat to the coast, leaving behind him all of his photographs and collections, and merely saving his journal. His hope of being able to reach the Congo, or even the upper Nile, had thus been frustrated. The map which accompanies the account of the expedition, 'A Journey to Ashango Land' (London, 1867), is based upon fifteen observed latitudes and seven longitudes, and up to this day it is the only authority on the geography of the greater part of the country delineated. It proves at the same time that the sketch-map published previously had conveyed a very fair notion of the general features of the country. This achievement was rewarded by the Royal Geographical Society by electing Du Chaillu one of its honorary members.

After a few years spent in the United States, in the course of which he delivered lectures and wrote several books for young folk,* who were very fond of "old Paul," Du Chaillu travelled in Scandinavia. The fruits of this expedition were a delightful book of travel, 'The Land of the Midnight Sun' (London, 1881), and an ambitious historical work on 'The Viking Age' (London, 1889), a work full of information, although its readers will hardly accept the author's conclusion that the English-speaking communities derive their remarkable energy and love of the sea from the warlike and ocean-loving tribes of the Scandinavian North.

Du Chaillu's body has been embalmed, and, by desire of his friends, will be forwarded to America.

E. G. RAVENSTEIN.

Obituary of the Year.

The following is a list of the Fellows who have died during the year 1902–1903 (April 30):—

Admiral E. S. ADEANE; General W. C. BANCROFT; Colonel A. F. BARROW; Lieut.-General R. S. BAYNES; ROBERT BERRIDGE; Dr. ISAMBARD BRUNEL; WILLIAM BULL; A. D. CAMPBELL; SAMUEL HORACE CANDLER; Lord CHEYLESMORE; ROBERT CLARK; Sir DANIEL COOPER; ARTHUR COPELAND-GRIFFITHS; NATHANIEL CORK; JAMES CORNWELL; Sir JOHN W. COX; W. B. CRACKNALL; GEORGE A. CRAIG; Dr. W. H. CROSSE; DONALD CRUIKSHANK; GEORGE DANFORD; Sir JULAND DANVERS; Sir ROBERT HENRY DAVIES; C. S. DICKEN; JOSHUA ELLISON; PATRICK F. EVANS; W. D. FANE; J. DUNN GARDNER; J. H. GLADSTONE; MATTHEW GRAY; Right Hon. R. W. HANBURY; L. C. HENRY; Sir EDWARD HERTSLET;

* Among Du Chaillu's minor works are 'Stories of the Gorilla Country' (1867); 'Wild Life under the Equator' (1868); 'Lost in a Jungle' (1869); 'My Apingi Kingdom' (1870); 'The Country of the Dwarfs' (1871); 'The Land of the Long Night' (1900).

Sir Arthur Hodgson; E. A. Hughes; P. J. Hughes; R. Irvine; Major T. G. Johnson; H. C. Langton; Syad Mohammed, Khan Bahadur Latif; J. A. H. Louis; Colonel C. R. Macgregor; Charles Gilbert Master; J. Oakley Maund; Philip Michelmore; A. Michie; Admiral H. M. Miller; Captain A. B. Molesworth; Colonel J. Morland; J. Linton Palmer; J. Dickson Park; Charles Pharazyn; George Philip; Josiah Pierce, jun.; Dr. Wordsworth Poole; Henry Porter; Major J. W. Powell; Rev. T. W. Prickett; Dr. G. Radde; Julian Ralph; Canon Rawlinson; H. C. Ross; Edward Russell; Thomas Rudd; W. A. Sanford; Dr. Karl von Scherzer; Captain Wm. Francis Segrave; James Shand; Wm. Shawe; Field-Marshal Sir J. L. A. Simmons; H. D. Skrine; Captain W. H. Smith; Howard Spensley; Lieut. H. T. G. Stack; General J. A. Steel; Sir A. K. C. Stepney; R. A. Sterndale; James Stevenson; J. S. Taylor; A. S. Truman; George Vacher; J. D. W. Vaughan; Thomas Ward; Captain Wm. Watson; E. W. Whinfield; J. A. Willans; E. E. Wood; Major H. J. P. Woodhead.

CORRESPONDENCE.

The "Tanganyika Problem."

It is probable that any military leader must feel unmixed delight when, after a preliminary attack upon a hostile country, he sees his adversary's forces taking up exactly those positions from which he knows they must retreat, and their evolutions being conducted in a manner that will ensure his own entire victory.

I do not pretend to know whether any one ought to have such feelings, but I must plead guilty to having experienced something of this sort growing within me while I read in your last issue Dr. Blanford's article upon the position I have occupied with respect to the Tanganyika problem. The essay opens with a kindly reference to the extent and thoroughness of the work accomplished by the two African enterprises which I had the honour to command, and for this, especially in the interests of those I served, I am duly grateful. Moreover, I am further almost as much surprised as gratified to find that so eminent a geologist as Dr. Blanford now completely accepts my main contention, namely, that the halolimnic fauna of Lake Tanganyika is a marine relic, for I have a vivid recollection of the geological opposition which existed to this view when I first began to talk about the matter in 1897. But although he thus receives the major portion of my solution of the problem far more favourably than I had anticipated, Dr. Blanford at the same time sets out to accomplish what he evidently considers to be the complete slaughter of a number of the minor points I raise. The matters in question consist of views and statements concerning the geology of Central Africa, the distribution of its fishes and mollusca, and the origin of fresh-water faunas in general. They are thus of some general importance, and Dr. Blanford will consequently perhaps forgive me if I now in turn proceed to point out to your readers that, after carefully surveying the effect of his attack, the matters in question appear to be not even scotched, far less slain, while the explosive arguments he uses have had such a nasty habit of going off inside his own trenches, that the actual "butcher's bill" has been greater there than in the positions he intended to assault. But to the point. Dr. Blanford, after reviewing the reasons which I gave for regarding the Drummond formations as marine, remarks that "the bivalve shells of Tanganyika are exclusively fresh-water types." This is great news! I have intentionally avoided saying anything about the actual affinities of the bivalves of Tanganyika, because I do not at present feel

competent to deal with the matter, but I have a strong impression that several of these shells, notably the so-called *Unio burtoni* and others, have been wrongly placed by the conchologists, while the very similar shells from Drummond's beds were regarded by Prof. Rupert Jones, at any rate the last time I saw him, as esturine forms. Under these circumstances, would any cautious person affirm, as Dr. Blanford does, that the shells in question were "exclusively fresh-water types"? My critic then continues, "The echinoderm noticed by Dr. Gregory was of doubtful origin, and Oliocene (*sic*) age," so that it clearly could not have come from Drummond's beds. Well, but is it an Oligocene species, or if so, is this species possibly Triassic also? Continuing, Dr. Blanford says of the Drummond beds, "It is more likely that they, as in the case of their South African representatives, are of fresh-water origin and very largely fluviatile." It is difficult to know where to begin with this series of assertions, since the latter part is based on an erroneous assumption in the first, but at a venture it may be stated for general information that these beds are like nothing at all in South Africa, and whether they are marine or not, they are certainly not fluviatile, unless deposits like our Lancashire limestones are to be considered as having originated in rivers. My critic proceeds, however, in this matter apparently under a sense of insecurity, for he remarks, "The point would hardly have been raised but for the circumstance that Mr. Moore has attacked what he calls Murchison's erroneous hypotheses concerning African stability. If, however, the strata here termed Drummond's beds are of inland origin, Murchison's views are not very far wrong, and the theory that Central Africa is an ancient land-mass is greatly strengthened." With respect to the first part of this contention, I would refer your readers to the original statement of Murchison himself, the whole statement as it stands with its reference to the absence of volcanoes south of the equator and the rest of it, and then to the simple geographical facts which were observed by Götzen and others before me; while with respect to the latter part of the above citation, the answer is already contained in the preceding paragraph.

Dr. Blanford is still further dissatisfied with my term "eurycolpic fold," which he translates "broad bosomed," and then criticizes. If, however, he will look the word up again more carefully, he will find that it means ridged and furrowed like the sea, or like the folds in a garment, as well as broad bosomed, and I really must protest on my own part against his suggestion of "trough-valley," for a more unsightly and evil-sounding expression it is difficult to imagine. In this connection my critic also makes the uncommonly true assertion that the difficulty of accounting for the rift-valleys is not removed by renaming them. There is, however, some reason why horribly cacophonous colloquial names like "graben," "rift-valley," and "trough-valley," which all mean different things, and none of which describes the folds in question, should be discontinued, and I may as well reassert that these valleys are usually folds; they are not "longitudinal blocks let down by trough faults," as Dr. Blanford dogmatically asserts.

It is thus obvious that there is some difference of opinion between me and Dr. Blanford upon these more purely geological by-products of the Tanganyika investigations, and it will also be apparent that there is reason to suppose that they may not be settled in the manner Dr. Blanford appears to anticipate. We may now turn to the more purely zoological questions relating to the same subject. But in so doing, I should like to get at the exact meaning of Dr. Blandford's expression that here "we enter upon debatable ground" (p. 271). If he means that he himself, as a geologist, feels less competent to deal with the matters in question, I am quite content, and his case is proportionately weakened. But if he means that the zoological evidence is more debatable, *i.e.* less clear than the geological, I would

refer your readers to p. 338 of my recent work, where, speaking of some of these very matters, I have said, "The problem is not one which it appears can be solved along geological lines, but the facts of zoology are before us, and are plain enough to any one who likes to take the trouble to understand them; and if the negative geological appearances of Central Africa remain, and in reality cannot be brought into accord with them, this simply shows the impotence of the geological, as compared with the zoological, methods of research—zoological evidence having, in fact, to be brought forward to indicate to geology the gross outline of the past history of Africa, and the way out of the theoretical entanglements in which it is at present wrapped up." Thus, if what I have just suggested should be Dr. Blanford's meaning, I see as little truth in his assertion as I fancy any one else will.

Moreover, Dr. Blanford often appears to be under a misconception as to whose views he is attacking, for I have expressly stated that I have adopted Dr. Günther's idea that the fresh-water fishes of Africa appear to have spread out from a point of origin to which Tanganyika would correspond, and it is therefore obvious that the notion that the Cichlidæ have spread themselves in this way from Tanganyika is not my invention, whether it is true or not. The views respecting the origin of fresh-water faunas in general, which are given in the second chapter of my work, are expressly stated to be something distinct and independent from the main object of the book itself. These hypotheses may be "startling," as Dr. Blanford puts it, but whether they are a return to pre-Darwinian days does not appear to me to matter much if they are on the right track. To use his own manner of criticism, Dr. Blanford "cannot be acquainted with all that has been written" since Darwin's time upon the sporadic origin of genera, but he will find that the subject was very lately considered and seriously advocated by Huxley in a paper in which he deals with the distribution of the Alpine gentians. I am further asked, if the fresh-water mollusca have originated from the marine fauna of a single geological age, where are the marine forms from which they have sprung? Well, I was under the impression that the so-called *pseudo-melanias* of the ancient oceans were conchologically indistinguishable from the fresh-water representatives of the genus *Melania*, and there are several others that could be named. Further, with respect to the migration of fresh-water organisms, Darwin certainly showed that the young of some mollusca could be carried on birds' feet, and Lyell did the like in a number of other cases, but what is to be said to the non-existence of the Tanganyika forms in Kela or Kivu, both of which are in direct water connection with Tanganyika? I want information about this, while with respect to the pretty obviously greater migratory powers of vertebrates, we have one fish, *Tilapia burtoni*, which has actually gone up the Rusisi river into Kivu, thereby showing that vertebrates do migrate more quickly than the molluscs in question, whatever Darwin thought. Continuing, Dr. Blanford remarks, "The specific differences between the different African lakes, strongly and repeatedly insisted upon by Mr. Moore as evidence of a separate origin of the mollusca inhabiting these sheets of water, will not weigh much with those who know on what trivial differences species of fresh-water mollusca are founded." Really, nothing could please me more than the latter part of this expression of Dr. Blanford's present views, for, in spite of much abuse from valued friends, I have always regarded conchology as somewhat "trivial"—as, in fact, more of a waste of time than a science; but concerning the main contention, I would ask my readers and Dr. Blanford himself, either to make themselves acquainted with the shells, radulæ, and anatomy of the different species of *Vivipara*, *Melania*, *Planorbis*, *Limnea*, and *Planorbia* occurring in the different African lakes, or to take my word for it that in all these instances the differences are not "trivial," and if they are not, supposing Darwin's opinion concerning the

migratory capacities of these forms be correct, how is it that they have not intercolonized in the different African lakes, some of which are actually in water connection one with another?

Finally, Dr. Blanford challenges my view with respect to the origin of certain forms of fresh-water fishes in America and Africa from an intervening ocean, and points out that I have not taken into account the supposed existence of a land connection between these continents in former times. "Mr. Moore," he says, "cannot be acquainted with all that has been written, both by biologists and geologists, as to the existence of a former land connection between Africa and America." Well, but what if I had read Suess's 'Antlitz der Erde,' if I knew something of Beddard's and Neumayer's observations, if I have also a vivid recollection of several discussions with Dr. Gregory upon this very subject, and if, after all this, I had and still "hae mi doots" about there ever having been any connection between the continents at all, was it necessary for me to dispute the matter with all these worthy people while dealing with another subject? I think it was far better not, for, as a great man said on a similar occasion, "one likes to be on good terms with one's contemporaries."

J. E. S. Moore.

Canadian Rocky Mountains.

Prof. Coleman, in his interesting paper on the Brazeau Ice-field, published in the May number of the *Geographical Journal*, calls attention to several points in connection with the Canadian Rocky Mountains. Firstly, he complains, and with reason, that in the former maps which the Geographical Society published to illustrate two papers of mine on the Rocky mountains of Canada, no mention was made of the work done by Mr. Stewart, although a portion of his map dealing with Fortress lake, the Athabasca pass, the Brazeau and Cataract rivers, had been copied. As Mr. Stewart's map is a most excellent and interesting one, covering a stretch of country over 150 miles long, from Morley to the Athabasca pass, this omission is much to be regretted. In the new map, however, which appeared in the last number of the *Journal*, this unfortunate mistake has been rectified. Secondly, Prof. Coleman objects to a statement of mine, that my explorations had been on the "eastern" side of the Rocky mountains. Surely the eastern side of the Rocky mountains comprises that part which lies east of the watershed, and as my explorations were all on that side, it is perfectly justifiable to say they were on the eastern side of the mountains. Thirdly, Prof. Coleman calls attention to the use of the name "Wapta" for one of the branches of the Kicking Horse river. It certainly seems a pity that a word meaning simply "river" should be given to one particular stream, and more especially so as the name for the glacier out of which that stream rises has consequently been named the Wapta glacier.* Another case of wrong nomenclature noticed by Prof. Coleman is that of the Whirlpool river, by Mr. Wilcox. In all the earlier accounts of the Athabasca pass, the Whirlpool river is made to run north-east from the Athabasca pass.

Lastly, Prof. Coleman mentions in his paper, that on looking up Cataract river "were splendid cathedral-shaped mountains, the most prominent of which we named Minster mountain. This peak is well seen from the prairie land of the Kootenay plains." These mountains are probably the same as those mentioned by Alex.

* The name Wapta for the Kicking Horse river has been condemned by the Geographic Board of Canada (see Annual Reports).—Ed. *G. J.*

Henry in his diary, February 7, 1811, at the time when he visited the Kootenay plains. To quote: "at eleven o'clock we passed the entrance of Rivière du Meurleton (Cataract river?). The course can be seen to wind for a long distance westward. Along this river I observed a high, steep mountain of singular shape, like a wall surrounded by a moat and ramparts, with an elevated central summit resembling a citadel, the whole having the appearance of a commanding fortress."* This mountain he called Mount Meurliton.

J. Norman Collie.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1902-1903.

Eleventh Ordinary Meeting, April 27, 1903.—Sir Clements Markham, K.C.B., F.R.S., President, in the Chair.

Elections:—*Rev. George Thos. Basden; Arthur Baume; Lieut. John Peers Boyd-Carpenter, R. Scots Fusiliers; Captain C. E. G. Charlton, R.A.; Major C. M. Dobell, D.S.O., R. Welsh Fusiliers; Joseph Charles Harvie; James F. Hoyne; Henry Mahler; Lieut.-Colonel Courtenay Clarke Manifold; Arthur Richmond; Frederick Bentfield Seaman; Henry Horace Seelig, Ph.D.; Charles John Ford Sevier.*

The Paper read was:—

"Four Years' Arctic Exploration in the *Fram*." By Captain Otto Sverdrup.

The Patron's Medal, awarded by the Council, was presented to Captain Sverdrup before the reading of the Paper.

Twelfth Ordinary Meeting, May 11, 1903.—Sir Clements Markham, K.C.B., F.R.S., President, in the chair.

Elections.—*William Frederick Bailey; William John Bernard Blew; Rev. Guy Julian Bridges; Clarence Ludlow Brownell; Herbert William Cadoux; Captain Archibald Neil Campbell, R.A.; Osbert Chadwick, late R.E.; Arthur John Chivers; Henry Augustus Frederick Currie; Lieut. L. J. H. Dickinson, 3rd Batt. Royal Dublin Fusiliers; Dugald Stewart Gilkison; Dugald Stewart Gilkison, Scottish Rifles; William Joseph Kenny; Donald Smallpiece, L.R.C.P.; Captain Arthur John Newman Tremearne, Victorian Mounted Infantry; Captain H. E. Trevor, Yorkshire Light Infantry; Captain C. H. Turner, Suffolk Regiment; Henry Hutchinson Spiller; Francis John Waring, C.M.G.; William Webster.*

Honorary Corresponding Member.

Prof. Otto Krümmel.

The Paper read was:—

"Cilicia, Tarsus, and the Great Taurus Pass." By Prof. W. M. Ramsay.

* 'Journals Alex. Henry,' 1799-1814, edited by Elliott Coues, pp. 685, 686.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Herzegovina. *Globus* **83** (1903): 191–194. **Katzer.**

Das Popovo polje in der Hercegovina. Von Dr. F. Katzer. *With Illustrations.*

Austria—Innsbruck. *Globus* **83** (1903): 157–160. **Jaeger.**

Innsbruck. Eine erdgeschichtliche Betrachtung. Von J. Jaeger.

Austria—Trieste. *Ann. Hydrographie* **31** (1903): 116–117. ——

Gegenwärtige und zukünftige Hafenanlagen von Triest. *With Plan.*

Belgium. *B.S. Belge Géologie* **16** (1902): 517–521. **Ertborn.**

Quelques mots au sujet de l'hydrologie de la côte belge. Par le baron O. van Ertborn.

Denmark—Limnology. **Wesenberg.**

Oversigt K. Dansk. Vidensk. S. Forhand. (1902): 257–303.

Sur l'existence d'une faune relicte dans le lac de Furesö. Par C. Wesenberg-Lund. *With Map.*

Europe. **Herbertson**

Descriptive Geographies from Original Sources. Europe. Selected by F. D. Herbertson. Edited by A. J. Herbertson. London: A. & C. Black, 1903. Size 7 × 4½, pp. xxiv. and 300. *Price 2s. 6d. Illustrations. Presented by the Publishers.*

France. *B.S. Belge Géologie* **16** (1902): 209–283. **Cooreman and Dollfus.**

Compte rendu des excursions de la Session extraordinaire de la Société belge de Géologie, etc., dans les départements français de la Marne et de l'Aisne (du 8 au 15 août 1901). Par T. Cooreman et G. Dollfus. *With Map and Illustrations.*

France—Brittany. *Ann. G.* **12** (1903): 19–30. **Vallaux.**

Sur les oscillations des côtes occidentales de la Bretagne. Par C. Vallaux.

See note in the Monthly Record (*ante*, p. 668).

France—Historical. **Lavisse and Blache.**

Ernest Lavisse. Histoire de France depuis les Origines jusqu'à la Revolution. Tome Premier. I. Tableau de la Geographie de la France. Par P. Vidal de la Blache. Paris: Hachette et Cie., 1903. Size 9½ × 7½, pp. 396. *Maps and Diagrams. Presented by M. P. Vidal et la Blache.* [To be reviewed.]

Germany—Strassburg. *Ann. G.* **12** (1903): 67–72. **Léon.**

Le port de Strasbourg. Par P. Léon.

Italy. **Baedeker.**

Italy. Handbook for Travellers by Karl Baedeker. First Part—Northern Italy, including Leghorn, Florence, Ravenna, and routes through Switzerland and Austria. Twelfth Remodelled Edition. Leipsic: K. Baedeker; London: Dulau & Co. 1903. Size 6½ × 4, pp. lxiv. and 564. *Maps and Plans. Price* 8 *m. Presented by Messrs. Dulau & Co.*

Italy—Alps. *B.S.G. Italiana* **4** (1903): 27–36. **Marson.**

Nevai di circo e traccie carsiche e glaciali nel gruppo del Cavallo. Del Prof. L. Marson. *With Illustrations.*

Italy—Assisi. *Tour du Monde* **9** (1903): 97–108. **Albizzi.**

Assise—La patrie d'un Saint par le Marquis degli Albizzi. *With Illustrations.*

Lake of Geneva. *Verh. Naturforsch. Ges. Basel* **16** (1903): 229–240. **Forel.**

Recherches sur la transparence des eaux du Léman. Par F.-A. Forel.

North-Western Europe. **Wiedenfeld.**

Die nordwesteuropäischen Welthäfen. London—Liverpool—Hamburg—Bremen—Amsterdam—Rotterdam—Antwerpen—Havre, in ihrer Verkehrs- und Handelsbedeutung. Von Dr. Kurt Wiedenfeld. Berlin: E. S. Mittler und Sohn, 1903. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instistuts an der Universität Berlin, Heft 3.) Size 10½ × 7, pp. xi. and 376. *Maps. Presented by the Publishers.*

Portugal. **Street.**

A Philosopher in Portugal. By Eugene E. Street. London: T. Fisher Unwin, 1903. Size 8 × 5, pp. viii. and 248. *Price 5s. net. Presented by the Publisher.*

Rumania—Walachia. *B.S.G. Română* **23** (1902): 1–162. **Martonne.**

Recherches sur la distribution géographique de la population en Valachie. Avec une Étude critique sur les procédés de représentation de la répartition de la population. . . . Par E. de Martonne. *With Maps. Also separate copy, presented by the Author.* [See note in the Monthly Record, *ante*, p. 669.]

Russia—Finland. *Meddelanden G. Fören. Finland* **6** (1901–1903): pp. 8. **Forsman.**

Några anteckningar rörande Gammelstadens geografi. Af J. Forsman, jun. *With Maps and Illustrations.*

On the physical conditions in the neighbourhood of Helsingfors.

Russia—Finland. **Hammarström.**

Meddelanden G. Fören. Finland **6** (1901–1903): pp. 12.

Några iakttagelser öfver vattendelaren vester om Kyrö älf. Af R. Hammarström.

On the western watershed of the Kyrö river.

Russia—Finland. *Meddelanden G. Fören. Finland* **6** (1901–1903): pp. 18. **Häyrén.**

Kumo elfs delta. Af E. Häyrén.

Russia—Finland. *Meddelanden G. Fören. Finland* **6** (1901–1903): pp. 119. **Rosberg.**

Fysisk-Geografisk beskrifning öfver Kyrkslätt socken. Af J. E. Rosberg. *With Map and Illustrations.*

Russia—Finland. *Deutsch. Rundschau G.* **25** (1903): 293–302. **Karstedt.**

Ein Streifzug durch Savolaks und Karelien (Finland). Von A. O. Karstedt. *With Illustrations.*

Russia—Novaya Zemlya. **Jäderholm.**

Ofversigt K. Vet.-A. Förhandlingar **58** (1901): 515–524.

Beiträge zur Kenntnis der Laubmoosflora Novaja Semljas. Von E. Jäderholm.

Russia—Oesel. **Skottsberg and Vestergren.**

Bihang K. Svensk. Vet.-A. Handlingar **27** (No. 7) (1901): pp. 97.

Zur Kenntnis der Vegetation der Insel Oesel. Von C. Skottsberg und T. Vestergren. *With Map.*

Russia—Sheep-farming. *B.S.G. Com. Havre* **19** (1902): 160–171. **Berthe.**

La plus grande exploitation agricole de l'Europe. Par E. Berthe.

Russia—Ural. **Bertrand.**

L'Oural est- il montagne d'Europe ou d'Asie? Par Jean Bertrand. (Extrait du

Bulletin de la Société Belge de Géologie, t. xvi., 1902, pp. 193–208.) Bruxelles, 1903. Size 10 × 6½. *Presented by the Author.*

Russia—Ural. *C. Rd.* **136** (1903): 629–631. **Duparc, Mrazec, and Pearce.**

Sur l'existence de plusieurs mouvements oro-géniques successifs dans l'Oural du Nord. Note de L. Duparc, L. Mrazec, et F. Pearce.

Sweden—Hydrography. ———

Svenska Hydrografisk-Biologiska Kommissionens Skrifter. I. Göteborg, 1903. Size 18 × 13. *Charts and Illustrations.*

Sweden—Lapland. *La G., B.S.G. Paris* **7** (1903): 162–176. **Rabot.**

La Laponie suédoise d'après les récentes explorations de MM. Svenonius et Hamberg. Par C. Rabot. *With Map and Illustrations.*

Turkey—Macedonia. **Abbott.**

The Tale of a Tour in Macedonia. By G. F. Abbott. London: E. Arnold, 1903. Size 9½ × 6, pp. xii. and 344. *Map and Illustrations. Price* 14*s. net. Presented by the Publisher.*

United Kingdom—Cambridgeshire. **Skeat.**

The Place-Names of Cambridgeshire. By the Rev. Walter W. Skeat. (Cambridge Antiquarian Society. Octavo Publications, No. xxxvi.) Cambridge, 1901. Size 9 × 5½, pp. vi. and 80. *Price* 3*s.* 6*d.*

United Kingdom—Climate. *Quarterly J.R. Meteorolog. S.* **29** (1903): 1–22. **Bayard.**

English Climatology, 1881–1900. By F. C. Bayard. *With Map.*

United Kingdom—London. *J.S. Arts* **51** (1903): 269–281. **Ginsburg.**

The Port of London. By Benedict W. Ginsburg.

United Kingdom—Wool. *J.R. Agricultural S.* **63** (1902): 409–416. **Webb.**

The Production of British Wool. By J. M. Webb. *With Illustrations.*

ASIA.

Asia. **Herbertson.**

Descriptive Geographies from Original Sources. Asia. Selected by F. D. Herbertson. Edited by A. J. Herbertson. London: A. & C. Black, 1903. Size 7½ × 4½, pp. xxxvi. and 298. *Illustrations. Price* 2*s.* 6*d. Presented by the Publishers.*

Central Asia. *B.S.G. Lyon* **18** (1903): 5–32. **Hedin.**

Réception et conférence du Dr. Sven Hedin, 3 février 1903. *With Map.*

India—Census. *J.S. Arts* **51** (1903): 328–339. **Baines.**

Gleanings from the Indian Census. By J. A. Baines.

India—Central India Agency. **Barnes.**

J. Bombay Br. R. Asiatic S. **21** (1902): 339–391.

Dhar and Mandu. By Captain E. Barnes. *With Map and Illustrations.*

India—Gujerat. *J. Bombay Br. R. Asiatic S.* **21** (1902): 413–433. **Bhandarkar.**

Gûrjaras. By D. R. Bhandarkar.

India—Historical. **Lane-Poole.**

Mediæval India under Mohammedan Rule (A.D. 712–1764). By Stanley Lane-Poole. London: T. Fisher Unwin, 1903. Size 8 × 5, pp. xviii. and 450. *Illustrations. Price* 5*s. Presented by the Publisher.*

India—Survey. ———

Synopsis of the Results of the Operations of the Great Trigonometrical Survey of India. Volume xxix. Descriptions and Co-ordinates of the Principal and Secondary Stations and other fixed points of the Great Arc—Section 8° to 11°, or Series A of the Southern Trigon. Prepared in the Office of the Trigonometrical Branch, Survey of India. Published under the orders of Major-General C. Strahan. Dehra Dun, 1899. Size 12 × 10, pp. x., xiv., and 322. *Maps. Presented by the Trigonometrical Branch, Survey of India.*

Indian Ocean. **Gardiner.**

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900. Edited by J. Stanley Gardiner. Volume i.

Part iv. Cambridge, 1903. Size 11½ × 9, pp. 347–472. *Plates and Illustrations. Price* 15*s. net.*

The editor's notes on the physical geography of the groups are concluded in this part.

Japan. *M.K.K.G. Ges. Wien* **45** (1902): 304–306. **Kutschera.**

Vulkanischer Ausbruch auf Torishima. Von Max Kutschera.

See note in the April *Journal* (p. 436).

Malay Archipelago—Borneo. **Molengraaff.**

Borneo Expedition. Geological Explorations in Central Borneo (1893–1894). By Dr. G. A. F. Molengraaff. English Revised Edition, with an Appendix on fossil Radiolaria of Central Borneo by Dr. G. J. Hinde. With Atlas of Geological Maps. Published by the Society for the Promotion of the Scientific Exploration of the Dutch Colonies. Leyden: E. J. Brill; Amsterdam: H. Gerlings. 1902. Size 11½ × 7½ (Atlas Folio), pp. xx., 530, and 56. *Maps, Plates, and Illustrations. Price* £2 12*s* 6*d.*

The Dutch edition of this work was reviewed in vol. xviii. of the *Journal* (p. 295).

Malay Archipelago—Borneo. **Spaan.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **20** (1903): 175–189.

Naar de Boven-Kelei (Sambalioeng). Een reis in de binnenlanden van Borneo (26 Augustus—17 September 1901). Door A. H. Spaan. *With Map.*

Malay Archipelago—Borneo. *J.S. Arts* **51** (1903): 507–519. **Walker.**

The State of North Borneo. By H. Walker.

Malay Archipelago—Celebes. **Hasselt.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **20** (1903): 229–240.

Nieuwe onderzoekingstochten van Dr. Paul Sarasin en Dr. Fritz Sarasin op Celebes. Door A. L. van Hasselt.

Malay Archipelago—Nias. *Globus* **83** (1903): 149–154, 171–178. **Raap.**

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Many readers, to whom the price of the first edition was prohibitive, will welcome the appearance of a popular edition of this work. Even without the superb full-page plates of the original, there are sufficient illustrations in the text to give a good idea of the general features of the range and the characteristics of its scenery.

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See note in the April number (p. 456).

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Le commerce du Sahara. Par E. Fallot. *With Map.*

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Sur un type spécial de dunes de la bordure saharienne. Note de B. P. G. Hochreutiner. [See note, *ante*, p. 556.]

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En Kort Oversigt over den anden norske Polarfærds geografiske Arbejde. Af Ritmester Isachsen. *With Map.*

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Beiträge zur Laubmoosflora Ostgrönlands und die Insel Jan Mayen. Von P. Dusén. *With Map and Plates.*

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Nautical Astronomy. *Ann. Hydrographiques* (1902): 7–129. **Arago.**

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Analysis of a work by Father Damian Kreichgauer.

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Central Europe. **Liebenow and Ravenstein.**
Liebenow-Ravenstein's Special-Radfahrerkarte von Mittel-Europa. Scale 1: 300,000 or 4·7 stat. miles to an inch. Sheets 52, Warschau; 64, Lódz; 65, Radom; 78, Wielun; 103, Prag; 104, Königgrätz; 105, Olmütz; 106, Bielitz. Frankfurt a. M.: Ludwig Ravenstein.

England and Wales. **Ordnance Survey.**
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Cambridgeshire, XLIX. 11, 14, 15, 16; L. 1, 5, 9; LX. 1, 2, 3, 4, 5, 6, 7, 8, 12, 16. **Dorset,** XI. 7; XXIX. 4, 14, 15. **Gloucestershire,** XVII. 1, 3, 7, 11; XVIII. 3, 14, 15; XXV. 2; XXIX. 15; XXXI. 4, 7; XXXII. 3, 4, 8; XXXIII. 9, 11, 12, 13, 15; XXXIX. 10; XL. 1; XLI. 10; XLII. 1; XLVIII. 6, 11, 13, 16; XLIX. 10, 14; LV. 5, 6, 8, 10, 11, 12, 13, 14; LVI. 5, 6, 8, 9, 10, 11, 12, 13, 14; LVII. 2, 4. 6, 7, 8, 9, 10, 11, 12, 13; LIX. 5; LXIII. 1, 2, 4, 8, 10, 11, 15, 16; LXIX. 12. **Leicestershire,** V. 9, 10; X. 13; XV. 7, 11, 12, 16; XVI. 1, 2, 4, 5, 10, 12; XVII. 1, 5, 9; XXII. 9, 16; XXX. 9. **Shropshire, XLIX.** 13, 14, 16; LVI. 2, 6, 8, 9, 12, 15, 16; LVII. 9; LVIII. 15; LXII. 13, 14; LXIII. 16; LXIV. 1, 6, 8, 10, 12, 13, 15, 16; LXV. 1, 9, 11, 13, 14, 15, 16; LXVI. 1, 2, 3, 4, 6, 7, 8, 10, 11, 13, 14, 16; LXVII. 1, 5, 9, 13, 14, 15; LXVIII. 4, 7; LXIX. 5, 6, 8, 10, 15; LXX. 1, 4, 8, 9, 12; LXXI. 2, 3, 5, 6, 7, 9, 10, 11, 12; LXXII. 2; LXXVI. 1. **Somerset,** V. 12, 15, 16; VII. 11; VIII. 14; XI. 3, 4; LXXXVII. 3, 5. **Staffordshire,** LV. 12; LVI. 1, 2, 4; LXIV. 8, 9, 10; LXVII. 3, 7, 11, 14; LXX. 4, 8, 12. **Warwickshire,** IV. 7, 8, 9, 10; VI. 13. **Worcestershire (and Do. Det. No. 1),** I. 11; VIII. 5; XXI. 1, 12; XXII. 1, 10; LIX. 3, 4, 7; LX. 3. **Yorkshire,** CCLXXXIII. 16; CCLXXXIV. 5; CCLXXXV. 4; CCLXXXVI. 6. 3*s. each.*

(*E. Stanford, London Agent.*)

Germany. **Symper.**

Karte des Verkehrs auf Deutschen Wasserstrassen im Jahre 1900. Nach den Ergebnissen der Statistik des Deutschen Reiches, nach Handelskammerberichten und anderweiten Quellen auf Anordnung des Herrn Ministers der öffentlichen Arbeiten zusammengestelt von Symper, Geheimer Baurat. Scale 1 : 1, 250,000 or 19·7 stat. miles to an inch. 4 sheets. Berlin : Verlag des Berliner Lith. Instituts. *Price* 6*m.*

By means of carefully selected symbols and colours, a great deal of most useful information is given on this map concerning German commerce, and exports and imports passing through Germany by means of the waterways. Coloured bands follow the principal rivers and canals, varying in breadth according to the commercial importance and extent of trade. The relative amount of exports and imports of the principal towns near the rivers is indicated by the character in which the town is shown, and information is given concerning the navigability of the rivers and other kindred subjects, both on the map itself and in the accompanying letterpress. In many respects this map resembles that published by the same department in 1887, of which it may, in fact, be considered a new edition.

London. **Bartholomew.**

The Pocket Atlas and Guide to London. By J. G. Bartholomew, F.R.G.S. Enlarged edition. London : John Walker & Co., 1903. *Presented by the Publishers.*

A new edition of a useful little pocket atlas of London, revised and enlarged. To save space, the index to streets, etc., is printed upon the back of the maps.

Portugal. **Portuguese Government.**

Portugal. Scale 1 : 100,000 or 1·5 stat. miles to an inch. Sheets 9 and 13. Levantada, construida e gravada pela Direcção geral dos trabalhos geodesicos e topographicos. Publicada em 1898, 1900.

Sweden. **Rikets Allmänna Kartverk.**

General Karta öfver Sverige. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Sheet 1; scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheets : 47, Risbäck; 49,

Lycksele; 50, Norsjö; 73, Bräcke; 79, Sundsvall; 84, Hudiksvall. — Scale 1 : 100,000 or 1·5 stat. mile to an inch. Sheet 105, Ockelbo. Stockholm : Rikets Allmänna Kartverk. *Presented by the Swedish Government Survey.*

Vienna. **Artaria.**

Plan der K.K. Reichshaupt und Residenzstadt Wien. Ausgabe, 1903. Bearbeitet im Geographischen Institute (Dr. Karl Peucker) der Verlagshandlung Artaria & Co. in Wien. Scale 1 : 25,000 or 586·4 yards to an inch. Vienna : Artaria & Co., 1903. *Presented by the Publisher.*

ASIA.

Philippine Islands. **Military Information Division, War Department, Washington.**

Map of Mindanao, Philippine Islands. Scale 1 : 792,000 or 12·5 stat. miles to an inch. Prepared in the War Department, Adjutant-General's Office, Military Information Division, Washington, 1902.

This is a preliminary map, and shows no hill-work. Outline and lettering are in black and sea blue.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. Sheets : 50, Sokoto; 51, Kano; 52, Lake Chad. London : Intelligence Division, War Office, 1903. Stanford. *Price 2s. each sheet. Presented by the Director-General of Mobilization and Military Intelligence.*

Algeria. **Ministère des Travaux Publics.**

Carte Géologique de l'Algérie. Troisième édition, rectifiée et complètée par le Service de la Carte Géologique de l'Algérie. Ministère des Travaux Publics. Gouvernement Général de l'Algérie. Paris : Ch. Béranger, 1900.

A comparison of this edition with that published in 1892 shows that considerable advance has been made in the knowledge of the geological formation of the country since that date. Information of a detailed character takes the place of generalizations and regions that were ten years ago unexplored geologically have now been surveyed. The map is well executed, and the registration of the colours very good.

Algeria. **Service Géographique de l'Armée, Paris.**

Carte de l'Algérie. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Sheet No. 120, Aïne Mlila. Paris : Service Géographique de l'Armée. *Price* 15.0 *fr.*

Central Africa. **Marchand.**

Mission Marchand. Haut Oubangui- Bahrel-Ghazel- Nil- Ethiopie- Djibouti. Carte publiée sous les auspices de la Société de Géographie de Paris. Dressée et dessinée par le Commendant Baratier d'après les travaux topographiques et astronomiques de les Mission Marchand et d'après les itinéraires des Officiers du Haut Oubangui, de M. Faivre (Expedition du Dedjaz Thessama), de la Mission de Bonchamp, de la Mission Bòttego, et des anciens voyageurs. Scale 1 : 1,000,000 or 15·7 stat. miles to an inch. 4 sheets. Paris : H. Barrère, 1903. *Presented by the Publisher.*

This map will be specially noticed in the *Geographical Journal.*

Tunis. **Service Géographique de l'Armée, Paris.**

Tunisie. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Sheet No. xxxviii., Ouargha. Paris : Service Géographique de l'Armée. *Price* 1.50 *fr.*

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Moosejaw Sheet (42), West of Second Meridian, revised to January 12, 1903; Touchwood Sheet (44), West of Second Meridian, revised to March 2, 1903; Saskatoon Sheet (53), West of Third Meridian, revised to October 22, 1902; Pincer Creek Sheet (81), West of Fifth Meridian, revised to March 9, 1903; Porcupine Sheet (82), West of Fifth Meridian, revised to February 20, 1903. Ottawa : Surveyor-General's Office. *Presented by the Surveyor-General of Canada.*

Peru. **Cisneros.**

Atlas del Perú, Politico, Minero, Agricola, Industrial y Commercial (con las

ultimas demarcaciones territoriales) y Texto descriptivo de cada departamento. Por Carolos B. Cisneros. Lima: Libreria é Imprenta Gil. *Presented by the Author.*

This atlas of Peru will be specially noticed in the *Geographical Journal.*

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps.—New Jersey. Scale 1: 570,240 or 9 stat. miles to an inch. New Mexico. Scale 1: 1,900,800 or 30 stat. miles to an inch. New York. Scale 1: 570,240 or 9 stat. miles to an inch. Chicago and New York: Rand, McNally & Co. *Price* $0.25 *each. Presented by the Publishers.*

These are new editions.

GENERAL.

French Colonies. **Pelet.**

Atlas des Colonies Françaises. Dressé par ordre du Ministère des Colonies par Paul Pelet. Livraison 9. Paris: Armand Colin et Cie. *Price* 3 *fr.*

Part No. 9 contains map No. 1, a general map of the world on an elliptical projection, showing the French colonies, transcontinental and other important railways, principal telegraph lines, and steamship routes. No. 2, a map of Northern and Central Africa, showing the French possessions; and No. 27, a sheet containing nine plans of French colonial naval depôts. In addition to these, there are ten pages of descriptive letterpress, as well as the title-page, list of contents and alphabetical index to the whole atlas. Although this part has but just appeared, the maps are dated January and July, 1901, and are consequently already out of date in several respects.

This atlas is now complete, and comprises altogether twenty-seven sheets of maps, besides numerous insets. Each map is accompanied by several pages of descriptive and statistical letterpress, and altogether it is a very creditable production. The maps are printed in colours, and the routes of important French explorers are shown in red. The price of the complete atlas bound in cloth is 30 francs.

World. **Schrader.**

L'Année Cartographique. Supplément annuel à toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Schrader. Douzième supplément contenant les modifications géographiques et politiques des années 1900–1901. Paris: Hachette et Cie., 1903. *Price* 3 *fr.*

A separate notice of this appears on p. 666.

CHARTS.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for May, 1903. London: Meteorological Office. *Price* 6*d. Presented by the Meteorological Office, London.*

United States Chart. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for April, and of the North Pacific Ocean for May, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Colombia. **Crease.**

Seven photographs of lakes of the Central Cordillera of the Andes of Colombia, taken by Herbert H. Crease, Esq. *Presented by Herbert H. Crease, Esq.*

An excellent set of platinotypes, measuring 8½ × 6½ inches.

(1 and 2) Lake Fuguene; (3) Lake Suesca; (4) Lake Siecha (part drained for treasure); (5) Lake Siecha (part undrained); (6) Lake Guatavita (showing Spanish cutting); (7) Lake Guatavita (taken from entrance to Spanish cutting).

Ecuador. **Rice.**

Thirty-two photographs taken on a voyage from Quito to the Amazon *viâ* the river Napo. By A. Hamilton Rice, Esq. *Presented by A. Hamilton Rice, Esq.*

These form an interesting addition to the Society's collection. The platinotypes, of which there are five, are specially clear. They are as follows:—

(1) The cathedral, Quito; (2 and 3) The Napo river at Negro Hurco, below the Curaray river; (4) Indian women, Curaray; (5) House of the better type, mouth of the Curaray river; (6 and 7) Camp on the Napo river, above the Curaray river; (8) The landing-place of a Napo village; (9) Trader and Indian family ascending the Napo river; (10) Peons resting at the Maspa river; (11) Camp in the eastern range of the Andes, upon the flood floor of the Cosanga river; (12) Indian village, mouth of the

Curaray river; (13) President's palace, and square where Garcia Moreno was cut to pieces; (14) Cantaliver bridge over the Maspa river, Eastern Andes; (15) Indians of Señor Atto, a Portuguese Peruvian cauchero of the Curaray, landing for a meal on one of the sandbars of the Napo; (16) Felipe Salagage, chief peon of Papallactan Indians; (17) Hacienda Itulcachi; (18) Under Chimborazo; (19) Chimborazo from the east; (20) Tambo Chuquipoquio; (21) Iquitos Peru, on the Amazon; (22) Type of South American canoe; (23) Archidona, capital of the Oriente; (24) Government House at Archidona; (25) Government officials and traders, Archidona; (26) Sunday morning in Archidona, rounding up the Indians; (27 and 28) Napo Indians, Archidona; (29) Napo village, six hours from Archidona.

Persia. **Penton.**

Ninety-five photographs of Persia, taken by E. Penton, Esq. *Presented by E. Penton, Esq.*

Mr. Penton described his route through Persia from India *viâ* Seistan in the *Geographical Journal* for July, 1902. It was during this journey that these photographs were taken. The following is a list of the titles:—

(1–9) Birjand; (10) Pond at Birjand; (11) Summer house, Birjand (12–14) Nushki; (15) Group at Nushki; (16) Interior of Nasratabad; (17) British Consulate at Nasratabad; (18) Servant at the Consulate; (19) Mohammed Ali Bros, Nasratabad; (20 and 21) Saindak; (22) Seistani camel-driver; (23 and 24) Mansur Khan; (25) Asadabad; (26) A morning halt; (27) Kundi; (28) A Persian Shiah; (29) Mushki-Chah; (30) Baua pass; (31) Tahib Chah; (32) Chah Mohammed Raza; (33 and 34) Groups of Beluchis; (35) A young Beluchi; (36) A well; (37) Camel-drivers eating; (38) Two men of Mr. Penton's escort; (39) Mr. Penton's servant and camel; (40) A halt; (41) Dalbandin; (42) At Dalbandin; (43) Padag; (44) Merui; (45) Orchard at Dehak; (46) Hazara; (47) Dasht-i-Piaz; (48) Camel owner and camels; (49) Shusp; (50) Dak bungalow; (51) Girdi-Talab; (52) Benn and his escort; (53) Bandan; (54) Persian Beluchis; (55) Seith Suliman; (56) Novad Chah; (57–59) Halting caravan; (60) Caravan in motion; (61) Caravanserai; (62) Push-ti-Dasht; (63) Kishingi; (64) Salabad; (65 and 66) Idoo the Pahlwan; (67 and 68) Robat; (69) Robat Dak bungalow; (70) Meshed; (71) Main Street, Meshed; (72) Bidar pass; (73) Crops at Amroni; (74) A Persian village; (75) A thana; (76 and 77) Interior of a Persian thana; (78–80) Chanhuk; (81 and 82) Mall; (83) New bungalow at Mall; (84) Thanadar at Mall; (85–89) Typical Baluchistan scenery; (90 and 91) A sandstorm; (92) A thanadar; (93 and 94) Crossing the Helmand lagoon; (95) Trato.

South Australia. **Maurice.**

Sixty-two photographs of South and Western Australia, taken by R. T. Maurice, Esq., 1901–1902. *Presented by R. T. Maurice, Esq.*

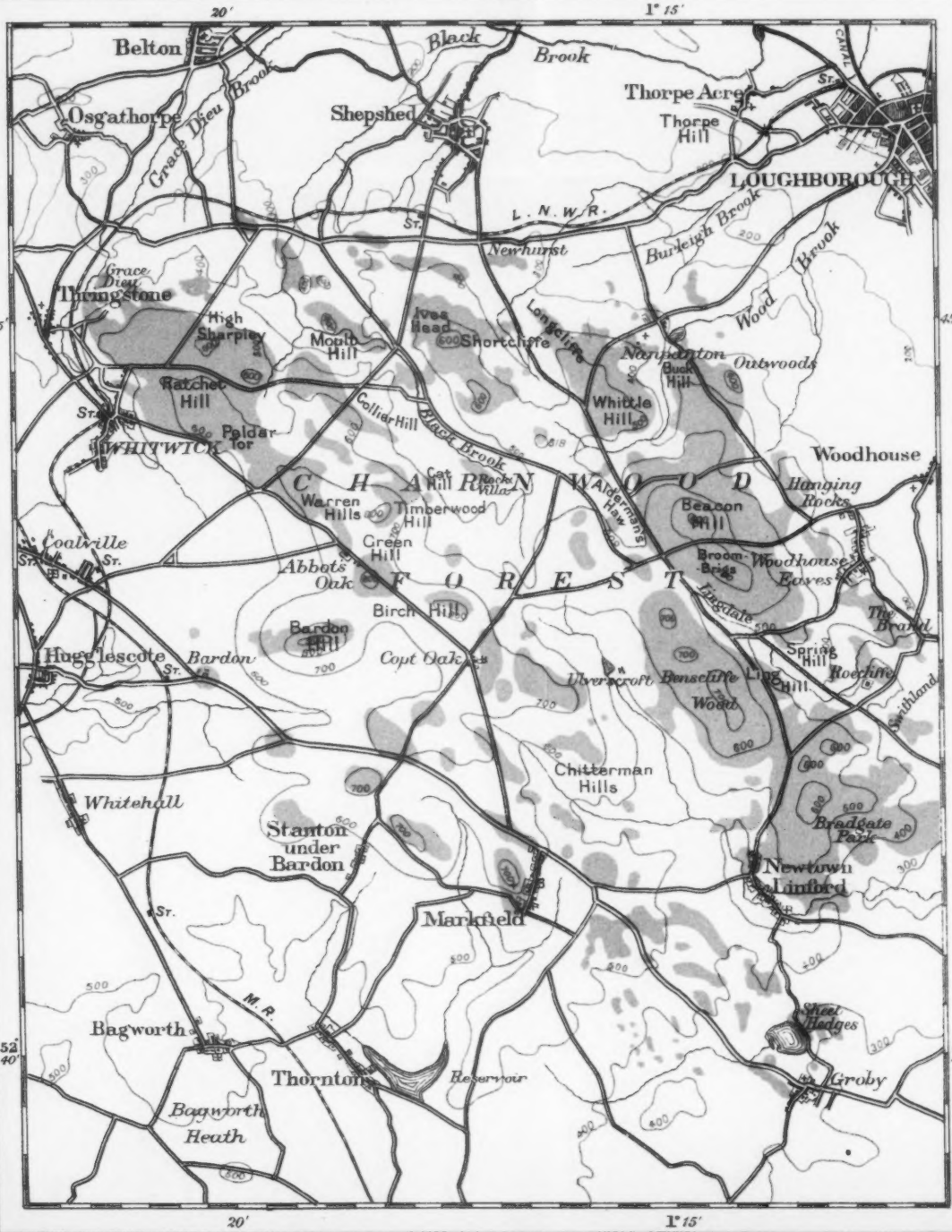
The expeditions upon which these photographs were taken extended from Ooldea well to the Rawlinson ranges, and from Fowler's bay to Cambridge gulf. Copies of some of the photographs have already been presented to the Society, and were noticed in the *Geographical Journal* for Dec. 1902. This album, however, contains some important additions, principally views of scenery.

(1) Mr. W. Murray and Mr. R. T. Maurice, with natives; (2 and 3) Showing measurements of natives; (4) Backs of natives, showing tribe marks; (5) Everard range black, "Napparinya Kallatinya," throwing boomerang; (6) "Napparinya Kallatinya," attitude of rest; (7) "Munjena," Waldoona black, throwing spear; (8) Fighting with boomerangs; (9) Ready to fight; (10) Painted for Corroborree; (11, 13, 14, 16, 17, 20, 25, 47) Parrina, native dam; (12, 18, 21, 22, 38, 41, 51, 52, 55–61) Glen Cumming; (15) Permanent water, Wilhanya; (19 and 39) Jamison range; (23 and 24) Portion of Jamison range; (26 and 49) Point on the Elder expedition; (27) Waldoona native women; (28) Bush to purify water in Rockhole; (29) Lubra; (30) Range between Rawlinson and Cavenough; (31) Murdered white man; (32 and 33) Sandhills, Jamison range; (34, 42, 43, and 50) Rawlinson range; (35) Permanent Koonunda water well; (37, 40, 48) Sladen water, Rawlinson range; (44) Mann range; (45) Gosse's pile (marked tree); (46) Koonundoo, native women; (53 and 54) Tree, Rawlinson range, marked by a member of the expedition led by Merton; (62) Native.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

CONTOUR MAP OF CHARNWOOD FOREST

Showing the outline of patches of Ancient Rock rising through the Trias. Based upon the work of H.M. Geological Survey & published by permission of the Director



Patches of Ancient Rocks rising through the Trias.

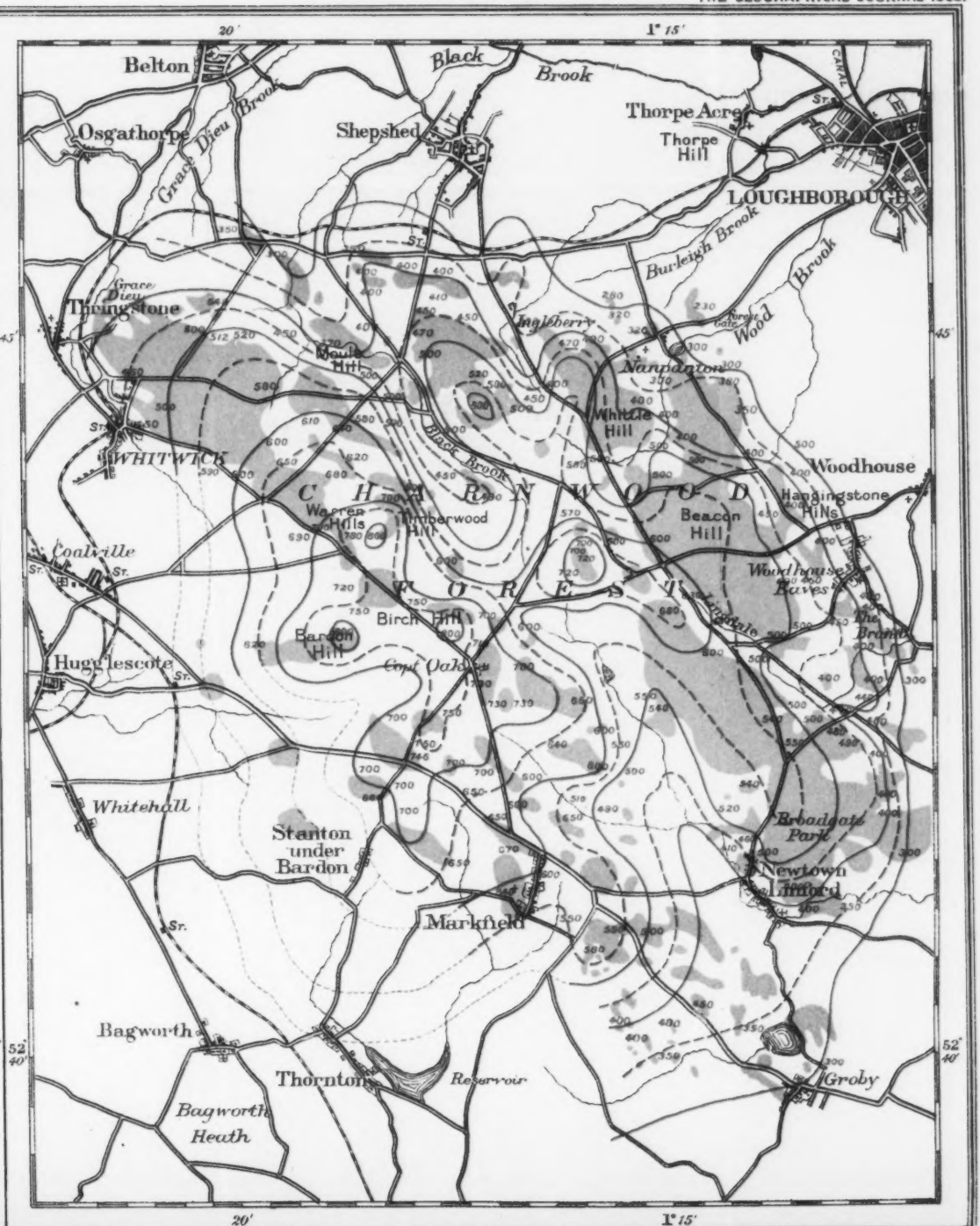
Contours at 100 ft. intervals

TRIASSIC MAP OF
CHARNWOOD FOREST

By Prof. W.W. Watts M.A.

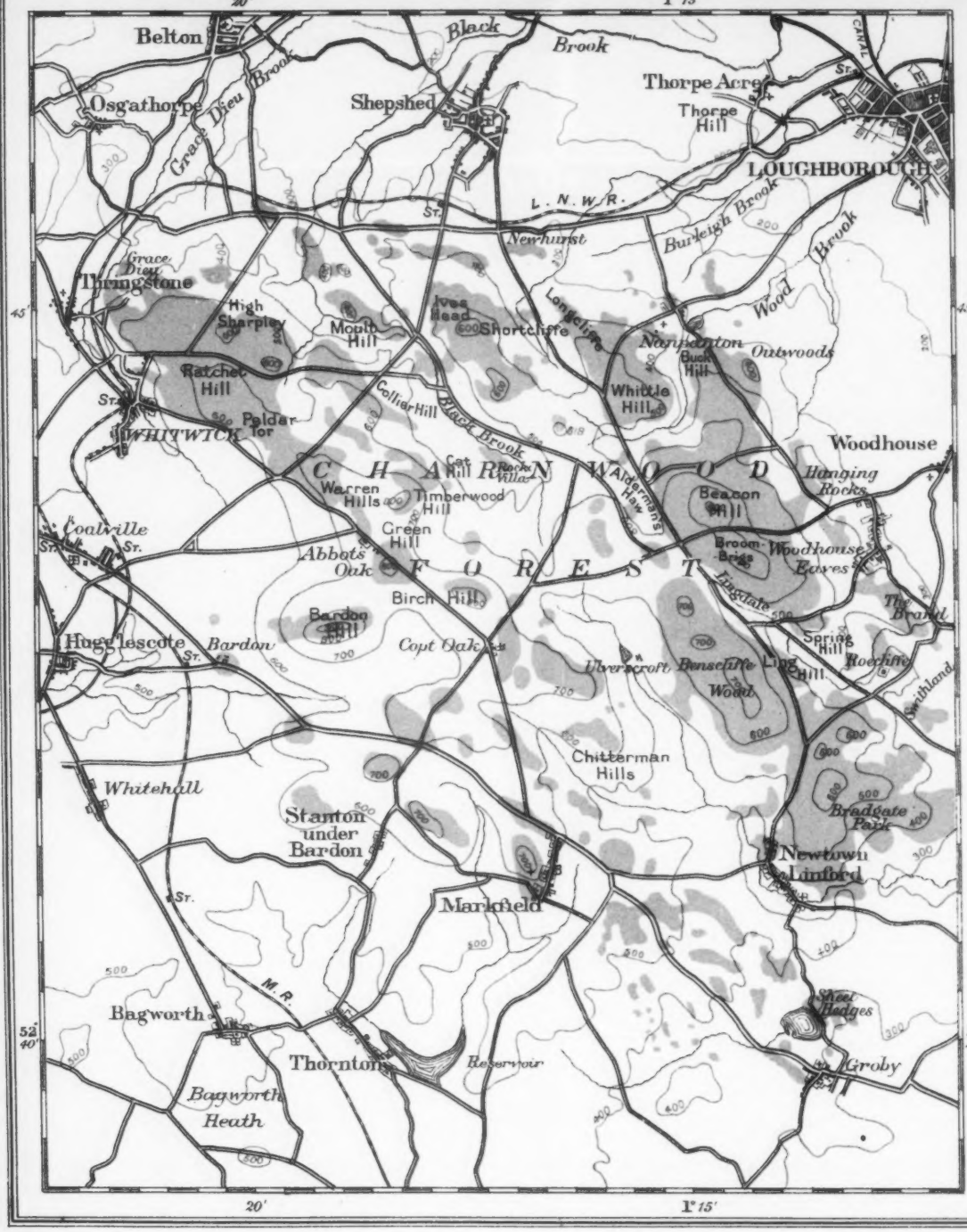
Showing approximately the contours of the Ancient Rocks beneath the Triassic Mantle. Based on observations made by Mr. C. Fox Strangways & Prof. W.W. Watts for H.M. Geological Survey.

THE GEOGRAPHICAL JOURNAL 1903.



Patches of Ancient Rocks rising through the Trias

Contours of Ancient Rock beneath the Triassic Mantle shown in red.



Patches of Ancient Rocks rising through the Trias.

Contours at 100 ft. intervals

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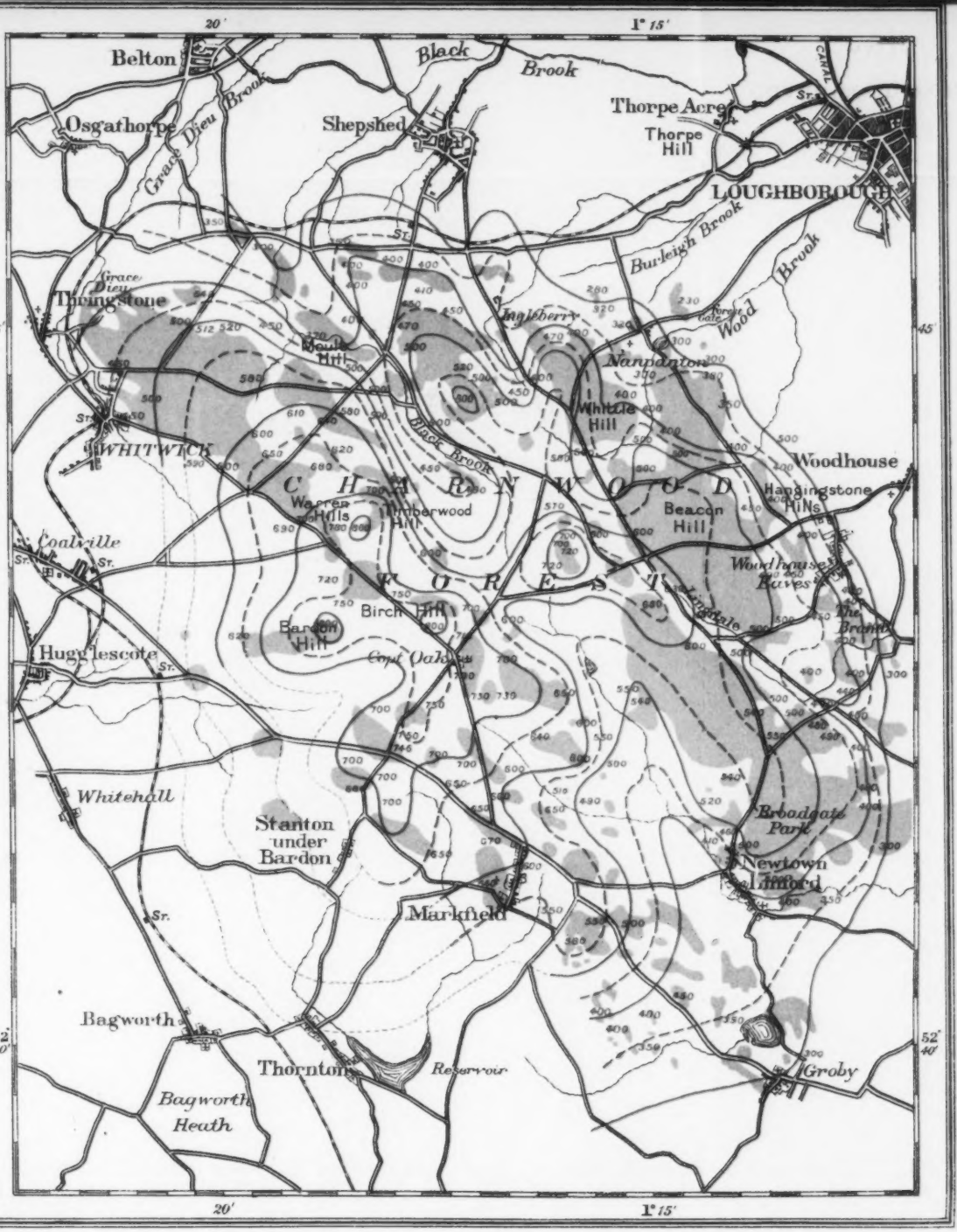

Patches of Ancient Rocks rising through the Trias.

Contours of Ancient Rock beneath the Triassic Mantle shown in red.

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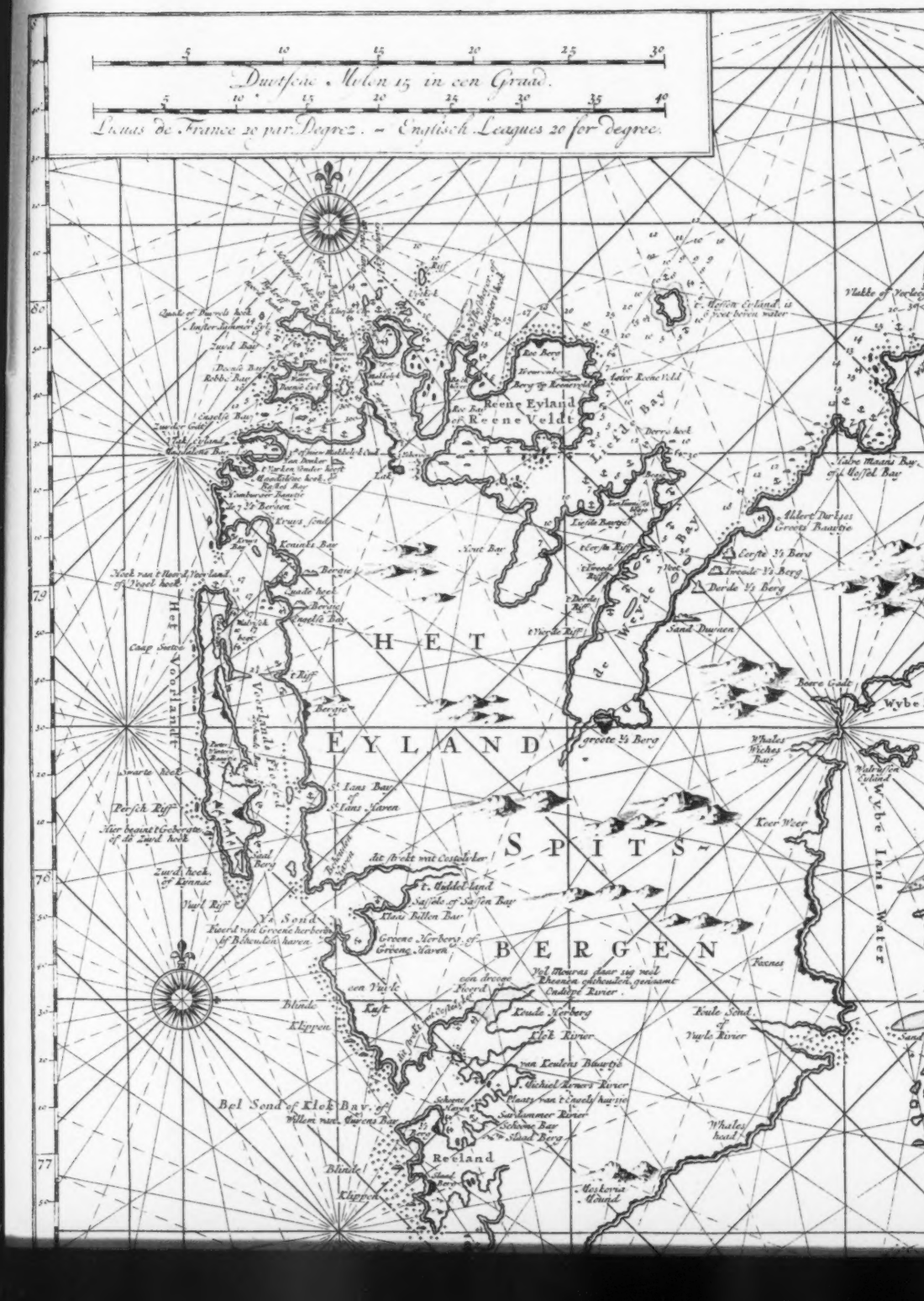
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Lieues de France 20 par Degrez. – Englisch Leagues 20 for degree.
Reene Eyland of Reene Veldt
Lieck Bay
Zuyder Zee
Het Vaste Landt
Eyland Spits-Bergen
Reeland
Bel Sond of Klok Bay
Wybe Jans Water
Whales head
Whales Wiches Bay
Sand Duynen
Keer Weer
Faxnes
Blinde Klippen
Zuyd hoek of Lijnaue
Perssik Riff
Smarte Rock
Seal Berg
Sassefo of Sassen Bay
Groene Herberg of Groene Haven
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Vogel Rivier
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Wybe Jans Water
Lommer berg
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Straat van Vinkopen
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Walrus Eyland
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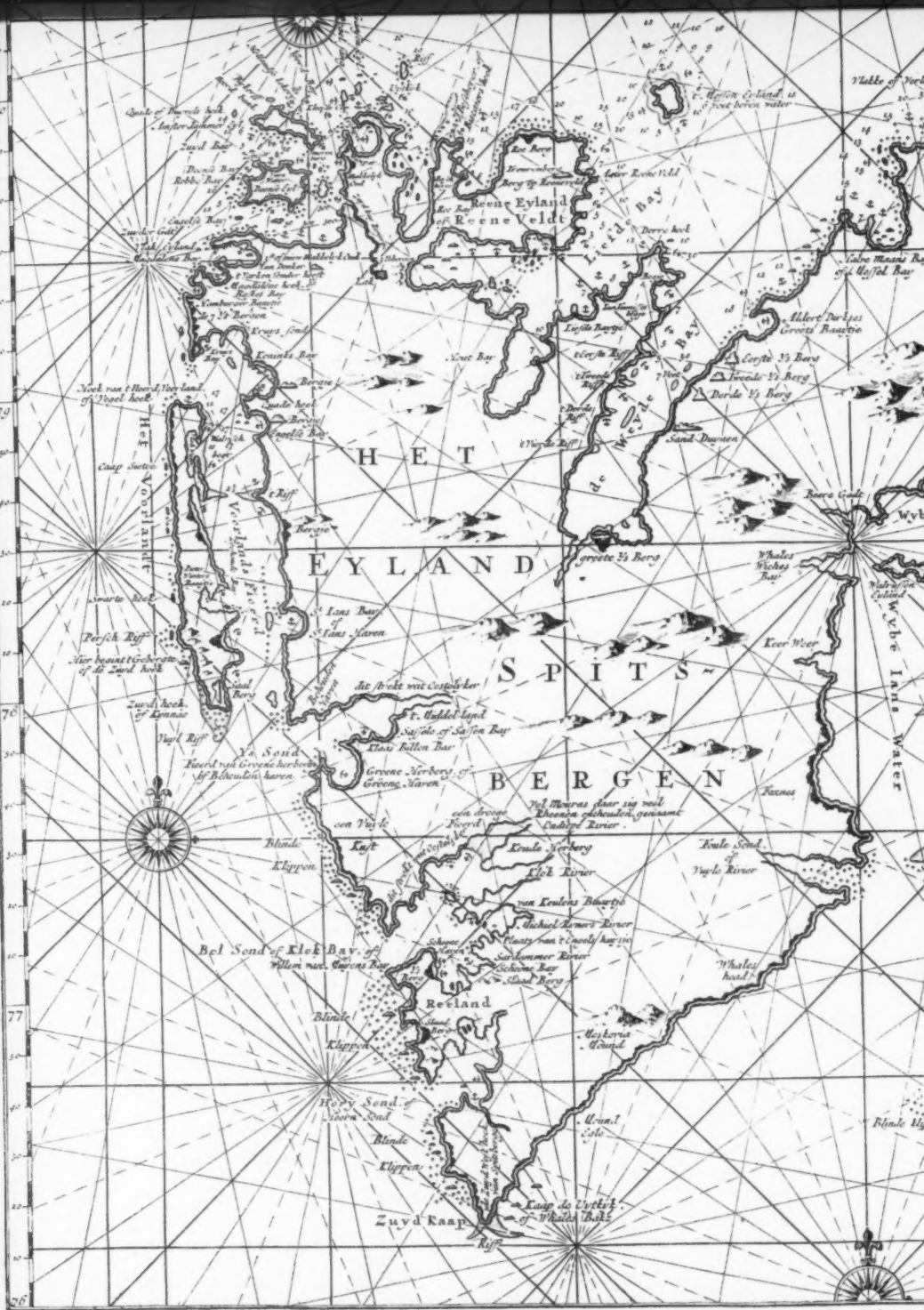
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Yz Sond
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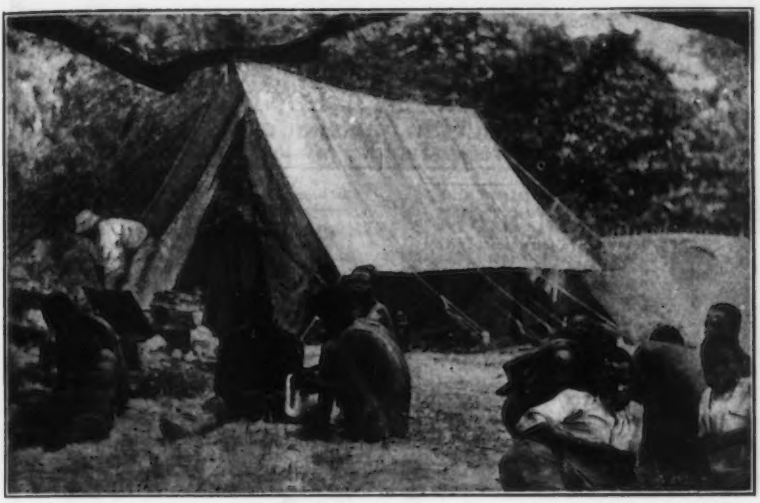

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Evening Meetings in June.—**Monday, June 8.** Travels in Mongolia. By C. W. Campbell, C.M.G.—**Wednesday, June 10.** The First Year's Work of the National Antarctic Expedition. By the President.—**Monday, June 22.** Explorations in Bolivia. By Dr. Evans.

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* See also pp. vi., viii. and x.

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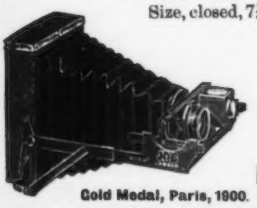

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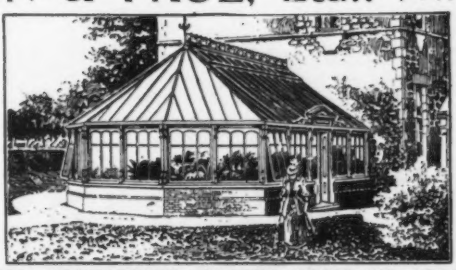

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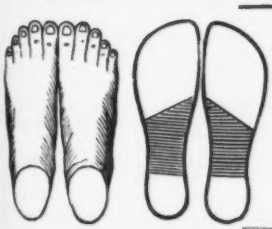

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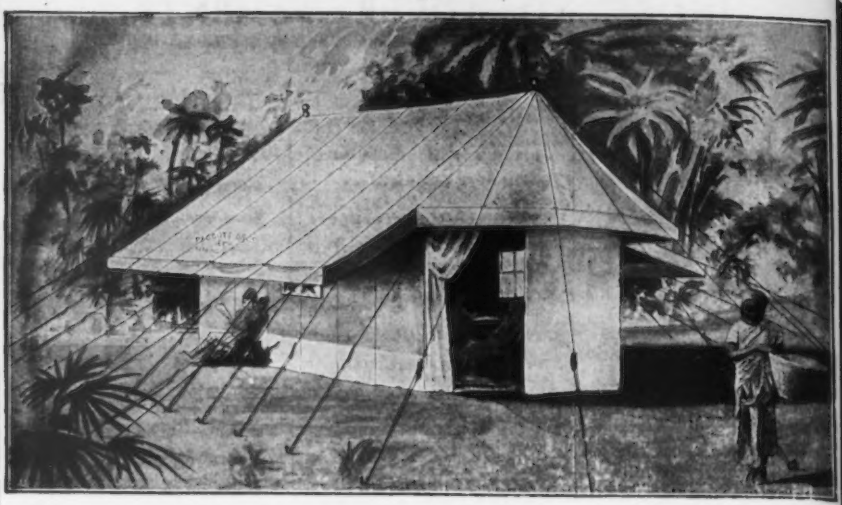

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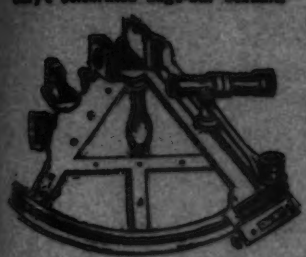

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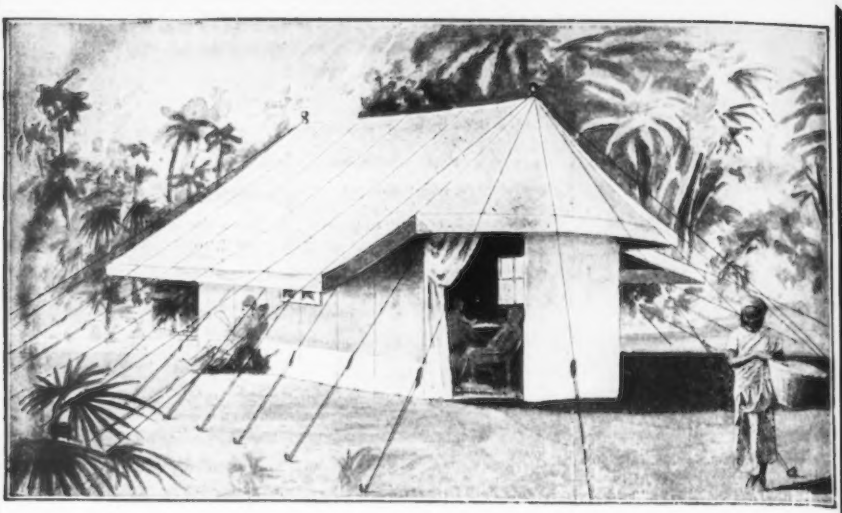

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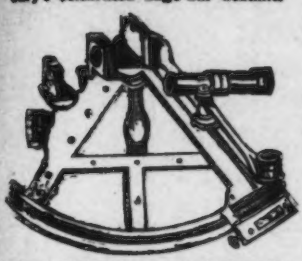

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